



## Technical Manual

### AVT GigE Vision Cameras

V2.0.8

26 November 2013

## Legal notice

### For customers in the U.S.A.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interferences will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Use a different line outlet for the receiver.
- Consult a radio or TV technician for help.

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart A of Part 15 of FCC Rules.

### For customers in Canada

This apparatus complies with the Class A limits for radio noise emissions set out in the Radio Interference Regulations.

### Pour utilisateurs au Canada

Cet appareil est conforme aux normes classe A pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

### Life support applications

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Allied Vision Technologies customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Allied Vision Technologies for any damages resulting from such improper use or sale.

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# Contents

|                                                    |           |
|----------------------------------------------------|-----------|
| <b>Contacting Allied Vision Technologies .....</b> | <b>5</b>  |
| <b>Introduction .....</b>                          | <b>6</b>  |
| Document history .....                             | 6         |
| Conventions used in this manual .....              | 7         |
| Precautions.....                                   | 8         |
| Cleaning optics.....                               | 9         |
| <b>Conformity .....</b>                            | <b>11</b> |
| <b>Specifications .....</b>                        | <b>12</b> |
| Prosilica GC650/650C.....                          | 12        |
| Prosilica GC655/655C.....                          | 14        |
| Prosilica GC660/660C.....                          | 16        |
| Prosilica GC750/750C.....                          | 18        |
| Prosilica GC780/780C.....                          | 20        |
| Prosilica GC1020/1020C .....                       | 22        |
| Prosilica GC1280 .....                             | 24        |
| Prosilica GC1290/1290C .....                       | 26        |
| Prosilica GC1350/1350C .....                       | 28        |
| Prosilica GC1380/1380C .....                       | 30        |
| Prosilica GC1380H/1380CH .....                     | 32        |
| Prosilica GC1600/1600C .....                       | 34        |
| Prosilica GC1600H/1600CH .....                     | 36        |
| Prosilica GC2450/2450C .....                       | 38        |
| <b>Camera attribute highlights .....</b>           | <b>40</b> |
| <b>Filter .....</b>                                | <b>41</b> |
| <b>Camera dimensions .....</b>                     | <b>42</b> |
| Prosilica GC750, GC1280 .....                      | 42        |
| Prosilica GC CCD models: .....                     | 43        |
| Tripod adapter .....                               | 44        |
| Optical flange focal distance .....                | 45        |
| Adjustment of C/CS-Mount .....                     | 47        |
| <b>Camera interfaces .....</b>                     | <b>48</b> |
| Status LEDs .....                                  | 48        |
| Gigabit Ethernet port .....                        | 49        |
| Camera I/O connector pin assignment .....          | 50        |
| I/O definition .....                               | 51        |

|                                                     |    |
|-----------------------------------------------------|----|
| Video iris output description.....                  | 54 |
| <b>Camera trigger</b> .....                         | 55 |
| Camera I/O opto-isolated user circuit example ..... | 55 |
| Camera I/O non-isolated user circuit example .....  | 56 |
| Trigger timing diagram .....                        | 57 |
| <b>Firmware update</b> .....                        | 59 |
| <b>Resolution and ROI frame rates</b> .....         | 60 |
| Prosilica GC650 .....                               | 60 |
| Prosilica GC655 .....                               | 61 |
| Prosilica GC660 .....                               | 61 |
| Prosilica GC750 .....                               | 62 |
| Prosilica GC780 .....                               | 62 |
| Prosilica GC1020 .....                              | 63 |
| Prosilica GC1280 .....                              | 63 |
| Prosilica GC1290 .....                              | 64 |
| Prosilica GC1350 .....                              | 64 |
| Prosilica GC1380 .....                              | 65 |
| Prosilica GC1380H .....                             | 65 |
| Prosilica GC1600 .....                              | 66 |
| Prosilica GC1600H .....                             | 66 |
| Prosilica GC2450 .....                              | 67 |
| Prosilica GC model comparison .....                 | 68 |
| <b>Description of the data path</b> .....           | 69 |
| Prosilica GC: monochrome cameras .....              | 69 |
| Prosilica GC: color cameras.....                    | 69 |
| Prosilica GC750C .....                              | 70 |
| <b>Appendix</b> .....                               | 71 |
| Sensor position of Prosilica GC cameras .....       | 71 |
| <b>Additional references</b> .....                  | 72 |
| <b>Index</b> .....                                  | 73 |

# Contacting Allied Vision Technologies

## Info



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# Introduction

This **AVT Prosilica GC Technical Manual** describes in depth the technical specifications of the Prosilica GC camera family including dimensions, feature overview, I/O definition, trigger timing waveforms, and frame rate performance.

For information on software installation read the **AVT GigE Installation Manual**. For detailed information on camera features and controls specific to the Prosilica GC refer to the **AVT GigE Camera and Driver Features** and **AVT GigE Camera and Driver Attributes** documents.

www



AVT Prosilica GC literature:

<http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-gc.html>

## Document history

| Version                      | Date        | Remarks                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| V2.0.0                       | 2011-Jul-22 | New Manual - RELEASE status                                                                                                                                                                                                                                                                                                                                                                                                      |
| V2.0.1                       | 2011-Oct-07 | Added note to Figure 34                                                                                                                                                                                                                                                                                                                                                                                                          |
| V.2.0.2                      | 2012-Sep-21 | <ul style="list-style-type: none"> <li>Renamed Camera I/O signals</li> <li>Reworked cleaning optics section</li> </ul>                                                                                                                                                                                                                                                                                                           |
| V.2.0.3                      | 2013-Jan-14 | <ul style="list-style-type: none"> <li>Updated the <b>exposure control</b> values</li> <li>Updated the Frame rate vs. Height graphs</li> <li>Removed the internal I/O circuit diagram</li> </ul>                                                                                                                                                                                                                                 |
| V2.0.4                       | 2013-Mar-26 | <ul style="list-style-type: none"> <li>Added <b>Status LEDs</b> section</li> <li>Added <b>Appendix</b></li> <li>Updated the RoHS directive</li> <li>Updated the pixel format naming according to the GenICam naming convention</li> <li>Added caution regarding the drive voltage for the video iris lens on page 54</li> <li>Added frame rate formulas in the <a href="#">Resolution and ROI frame rates</a> chapter</li> </ul> |
| V2.0.5                       | 2013-May-07 | <ul style="list-style-type: none"> <li>Updated the exposure control values in the <a href="#">Specifications</a> chapter</li> <li>Added VIMBA SDK link in the <a href="#">Additional references</a> section</li> <li>Updated AVT recommended cabling to Category 6 or higher in the <a href="#">Gigabit Ethernet port</a> section</li> </ul>                                                                                     |
| to be continued on next page |             |                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Table 1: Document history

| Version                  | Date        | Remarks                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| continued from last page |             |                                                                                                                                                                                                                                                                                                                                                                                           |
| V2.0.6                   | 2013-Jul-05 | <ul style="list-style-type: none"> <li>Added contact information for Allied Vision Technologies (Shanghai) Co. Ltd.</li> <li>Updated the links to <b>AVT GigE Installation Manual</b></li> <li>Added links to <b>AVT GigE Camera and Driver Features</b> document</li> </ul>                                                                                                              |
| V2.0.7                   | 2013-Oct-02 | <ul style="list-style-type: none"> <li>Added optical flange focal distance and maximum lens protrusion information on page 45</li> <li>Updated <a href="#">Cleaning optics</a> section</li> <li>Updated <b>vertical binning</b> values in <a href="#">Specifications</a> chapter</li> <li>Updated <a href="#">table 17</a> on page 40</li> <li>Updated links for AVT PvAPI SDK</li> </ul> |
| V2.0.8                   | 2013-Nov-26 | <ul style="list-style-type: none"> <li>Added chapter <a href="#">Description of the data path</a> on page 69</li> <li>Updated the Index</li> </ul>                                                                                                                                                                                                                                        |

Table 1: Document history

## Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

### Styles

| Style                   | Function                                                | Example                |
|-------------------------|---------------------------------------------------------|------------------------|
| Bold                    | Programs, inputs, or highlighting important information | <b>bold</b>            |
| Courier                 | Code listings etc.                                      | Input                  |
| Upper case              | Register                                                | REGISTER               |
| Italics                 | Modes, fields                                           | <i>Mode</i>            |
| Parentheses and/or blue | Links                                                   | <a href="#">(Link)</a> |

Table 2: Styles

## Symbols

### Note

This symbol highlights important information.



### Caution

This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.



### www

This symbol highlights URLs for further information. The URL itself is shown in blue.



Example:

<http://www.alliedvisiontec.com>

## Precautions

### Caution

**Do not disassemble the camera housing. Warranty is void if camera has been disassembled.**



This camera contains sensitive internal components.

### Caution

**Keep shipping material.**



Poor packaging of the product may cause damage during shipping.

### Caution

**Verify all external connections.**



Verify all external connections in terms of voltage levels, power requirements, voltage polarity, and signal integrity prior to powering the device.

**Caution****Cleaning.**

This product can be damaged by some volatile cleaning agents. Avoid cleaning the image sensor unless absolutely necessary. Please see instructions on optics cleaning in this document.

**Caution****Do not exceed environmental specifications.**

See environmental specifications limits in the Specifications section of this document. Special care must be taken to maintain a reasonable operating temperature. If the camera is operated in temperatures higher than the specified range, the camera should be mounted on a heat sink.

## Cleaning optics

**Caution**

AVT does not warranty against any physical damage to the sensor/filter/protection glass or lenses. **Use utmost care when cleaning optical components.**

**Caution**

**Do not touch any optics with fingers. Oil from fingers can damage fragile optical coatings.**

## Identifying debris

Debris on the image sensor or optical components appears as a darkened area or smudge on a camera image. Do not confuse this with a pixel defect which appears as a distinct point.

## Locating debris

First determine whether the debris is on the sensor glass, IR filter (if used), or lens. The farther away the debris is from the sensor, the blurrier the debris appears on a camera image.

Stream a live image from the camera using a uniform target, such as a piece of paper. To determine if the debris is on the camera lens, rotate the lens independent of the camera. If the spot moves, the debris is on the lens. Otherwise, the debris is on the IR filter (if used) or sensor glass.

## Color cameras with IR filter

Prosilica GC color cameras are equipped with an IR filter. With no lens or lens cap on a camera, the IR filter is exposed and debris can accumulate on it. This is the most probable location for debris. It should not be necessary to remove the IR filter for cleaning. Clean the outside of the IR filter glass using the techniques explained in the next section.

If it is determined that the debris is on the inside surface of the filter glass, or on the sensor glass, IR filter removal is necessary. Depending on the manufacturing date of your Prosilica GC camera, the IR filter may be slot type, or pinhole type. Slot type filters can be removed using a small flat head screw driver. Pinhole type filters require a pin spanner wrench for removal.

### Note



A pin spanner wrench suitable for IR filter removal is available for purchase from AVT.  
AVT P/N: E9020001

## Cleaning with air

Blow directly on the contaminated surface with moderate pressure, clean compressed air.

### Caution



**Do not exceed 6 bar (90 psi). If using canned air, approximately ~ 4.8 bar (70 psi) when full, do not shake or tilt the can, as extreme changes in temperature due to sudden cold air can crack the optic glass.**

View a live image with the camera after blowing. If debris is still present, repeat the process until it is determined that the particulate cannot be dislodged. If this is the case, proceed to the contact cleaning technique.

## Contact cleaning

Only use this method if the above air cleaning method does not sufficiently clean the surface. Use 99% pure isopropyl alcohol and clean cotton swabs. Wet the swab in the alcohol. Quickly wipe the optics in a single stroke. Prolonged exposure of alcohol on the swab can cause the swab glue to loosen and transfer to the optic glass. Do not reuse the same swab. Repeat this process until the debris is removed. If this process fails to remove the debris, contact AVT.

## Conformity

Allied Vision Technologies declares under its sole responsibility that all standard cameras of the **AVT Prosilica GC** family to which this declaration relates are in conformity with the following standard(s) or other normative document(s):

- CE, following the provisions of 2004/108/EG directive
- FCC Part 15 Class A
- RoHS (2011/65/EU)



We declare, under our sole responsibility, that the previously described **AVT Prosilica GC** cameras conform to the directives of the CE.



Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Any modifications not expressly approved in this manual may void your authority to operate this equipment.

# Specifications

## Prosilica GC650/650C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 659 x 493                                                                                              |
| Sensor                            | Sony ICX424AL, ICX424AQ for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/3                                                                                               |
| Cell size                         | 7.4 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 90 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC650: Mono8, Mono12, Mono12Packed<br>GC650C: Mono8                                                    |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 19 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.3 W @ 12 V DC                                                                                        |
| Trigger latency                   | 1.0 $\mu\text{s}$ for non-isolated I/O, 2.8 $\mu\text{s}$ for isolated I/O                             |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 104 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 3: Prosilica GC650/650C camera specifications

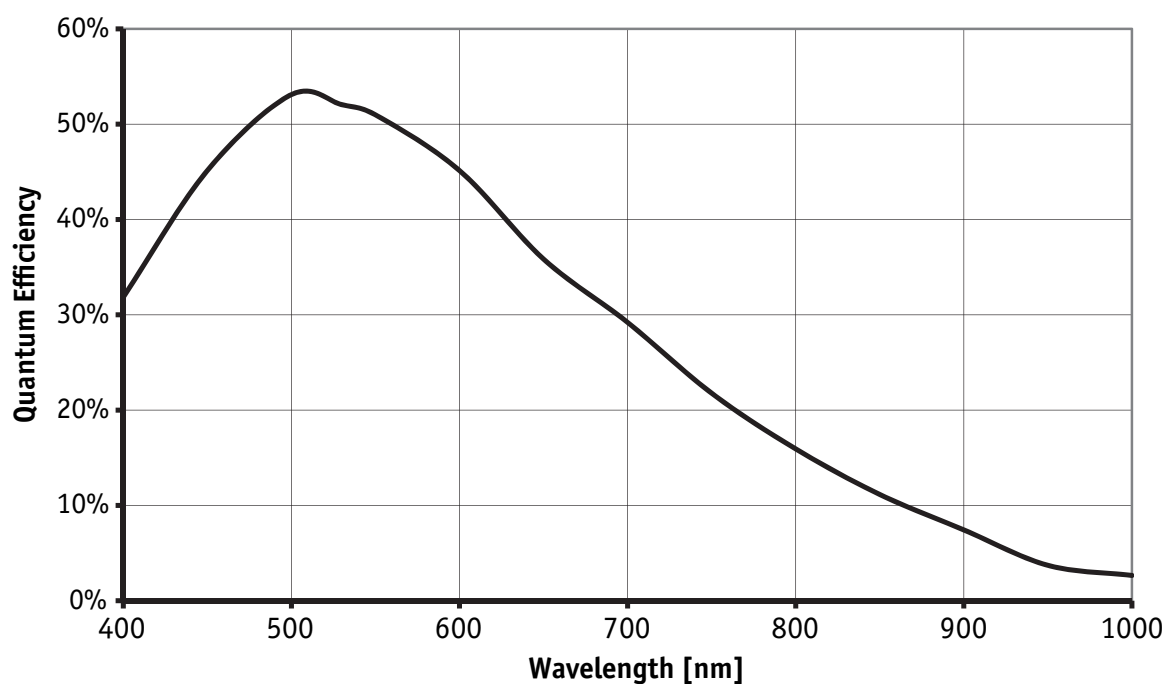


Figure 1: Prosilica GC650 monochrome spectral response

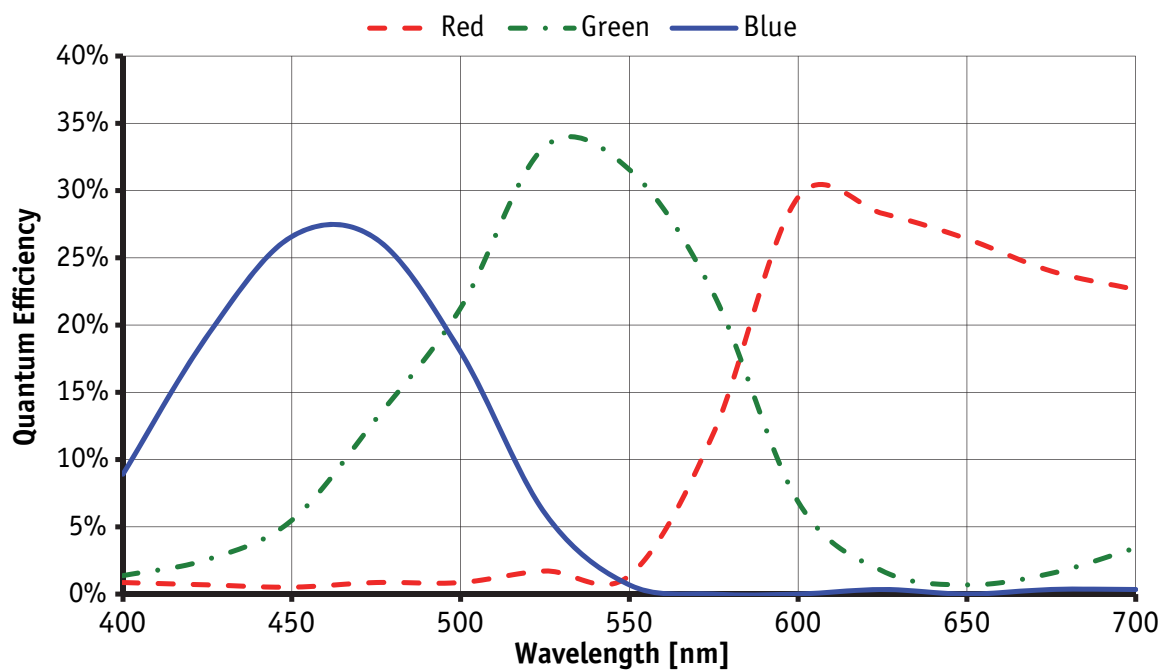


Figure 2: Prosilica GC650C color spectral response (without IR cut filter)

## Prosilica GC655/655C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 659 x 493                                                                                              |
| Sensor                            | Sony ICX414AL, ICX414AQ for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/2                                                                                               |
| Cell size                         | 9.9 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 119 fps                                                                                                |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC655: Mono8, Mono12, Mono12Packed<br>GC655C: Mono8                                                    |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 22 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| TTL I/Os                          | 1 input, 1 outputs                                                                                     |
| Opto-coupled I/Os                 | 1 input, 1 outputs                                                                                     |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.0 W @ 12 VDC                                                                                         |
| Trigger latency                   | 1.0 $\mu\text{s}$ for non-isolated I/O, 2.8 $\mu\text{s}$ for isolated I/O                             |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 105 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 4: Prosilica GC655/655C camera specifications

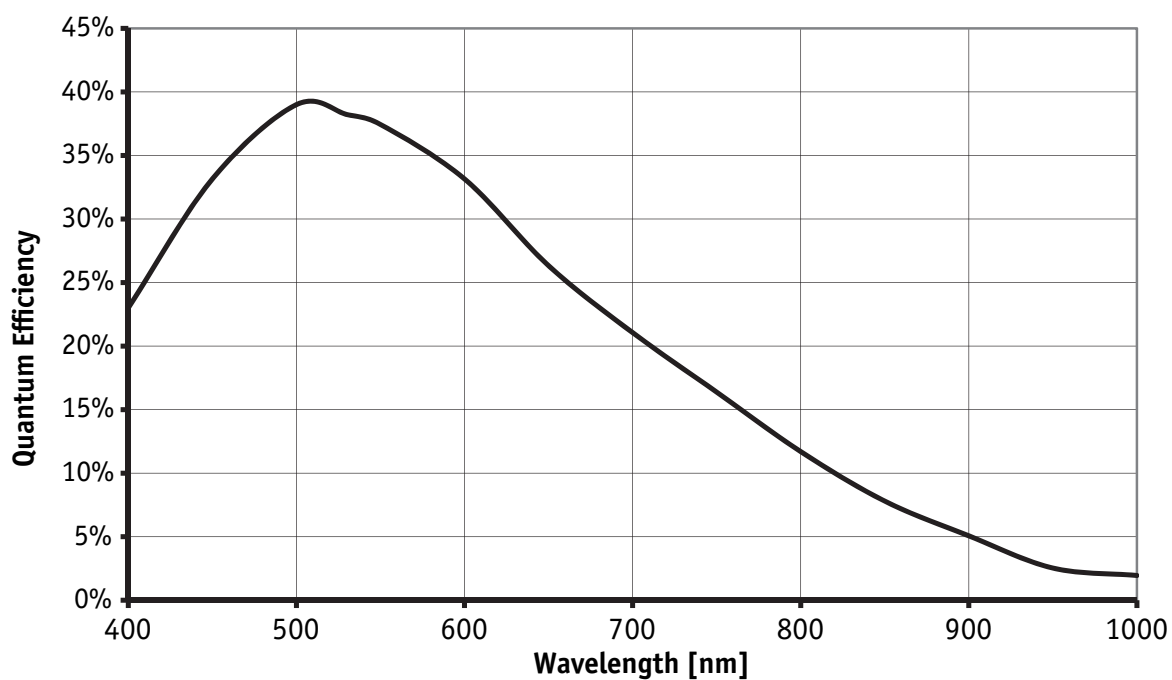


Figure 3: Prosilica GC655 monochrome spectral response

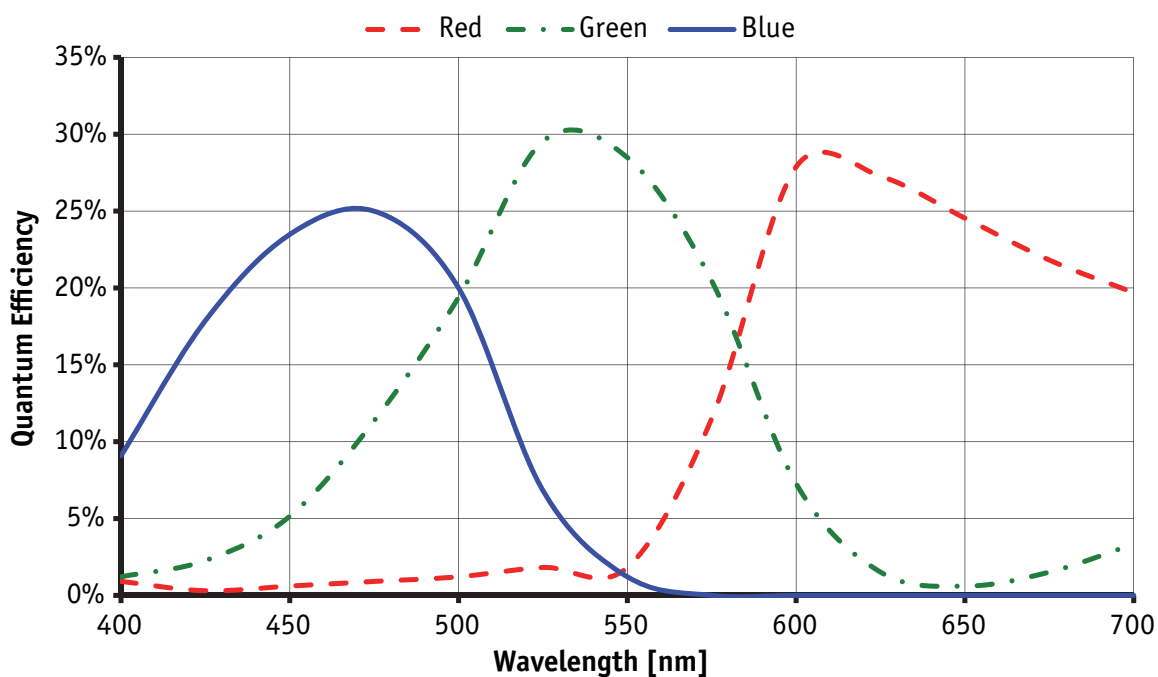


Figure 4: Prosilica GC655C color spectral response (without IR cut filter)

## Prosilica GC660/660C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 659 x 493                                                                                              |
| Sensor                            | Sony ICX618ALA, ICX618AQ for color                                                                     |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/4                                                                                               |
| Cell size                         | 5.6 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 119 fps                                                                                                |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC660: Mono8, Mono12, Mono12Packed<br>GC660C: Mono8                                                    |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 78.5 s; 1 $\mu\text{s}$ increments                                                 |
| Gain control                      | 0 to 34 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 outputs                                                                                     |
| Opto-coupled I/Os                 | 1 input, 1 outputs                                                                                     |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.0 W @ 12 VDC                                                                                         |
| Trigger latency                   | 1.0 $\mu\text{s}$ for non-isolated I/O, 2.8 $\mu\text{s}$ for isolated I/O                             |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 105 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 5: Prosilica GC660/660C camera specifications

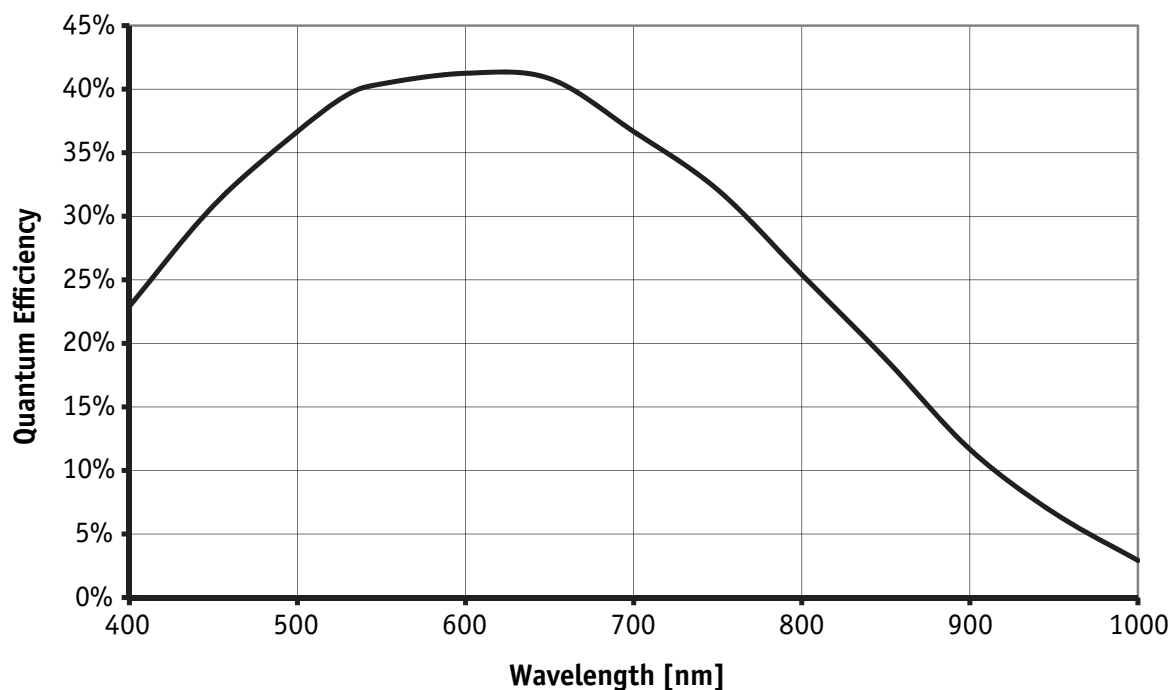


Figure 5: Prosilica GC660 monochrome spectral response

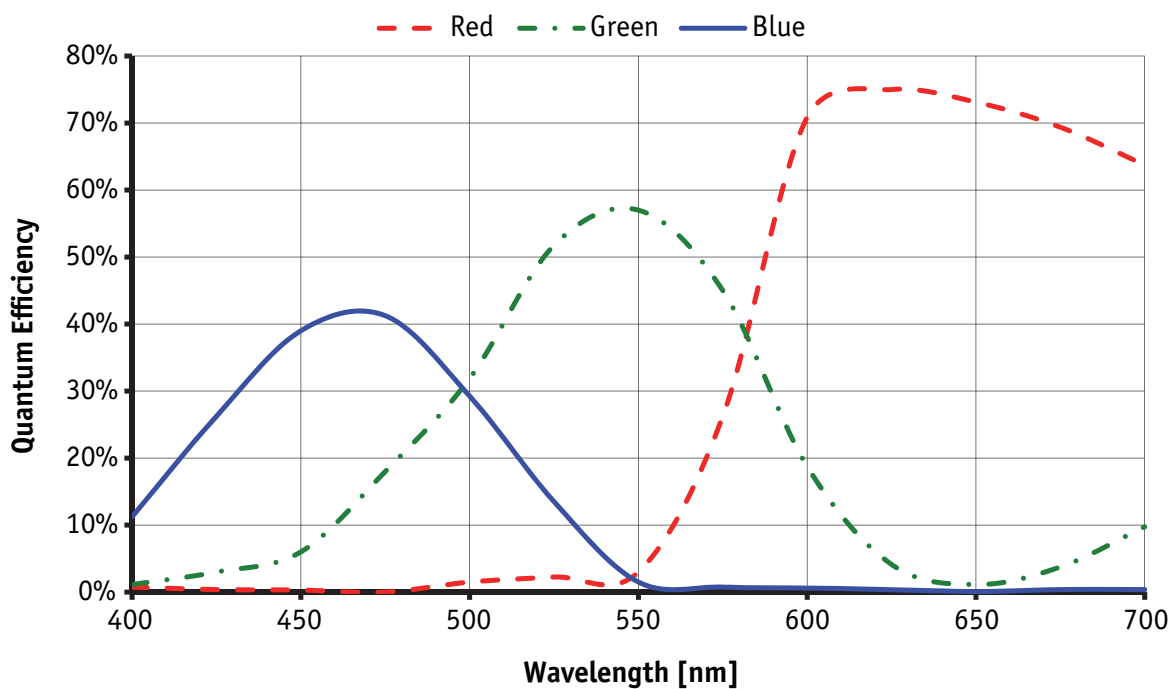


Figure 6: Prosilica GC660C color spectral response (without IR cut filter)

## Prosilica GC750/750C

| Feature                           | Specification                                                                                                   |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Resolution                        | 752 x 480                                                                                                       |
| Sensor                            | Micron MT9V022                                                                                                  |
| Type                              | CMOS Progressive                                                                                                |
| Sensor size                       | Type 1/3                                                                                                        |
| Cell size                         | 6 $\mu\text{m}$                                                                                                 |
| Lens mount                        | CS                                                                                                              |
| Max frame rate at full resolution | 67 fps                                                                                                          |
| A/D                               | 10 bit                                                                                                          |
| On-board FIFO                     | 16 MB                                                                                                           |
| Bit depth                         | 8/10                                                                                                            |
| Mono formats                      | GC750: Mono8, Mono10<br>GC750C: Mono8                                                                           |
| Color formats                     | BayerBG8, BayerBG10, RGB8Packed, BGR8Packed, RGBA8Packed, BGRA8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 30 $\mu\text{s}$ to 60 s; 1 $\mu\text{s}$ increments                                                            |
| Gain control                      | 0 to 48 dB                                                                                                      |
| TTL I/Os                          | 1 input, 1 outputs                                                                                              |
| Opto-coupled I/Os                 | 1 input, 1 outputs                                                                                              |
| RS-232                            | 1                                                                                                               |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXX-1XXXX                                      |
| Power consumption                 | 2.2 W @ 12 VDC                                                                                                  |
| Trigger latency                   | 31 $\mu\text{s}$ for non-isolated I/O, 43 $\mu\text{s}$ for isolated I/O                                        |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                                      |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                                  |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                          |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                                        |
| Operating humidity                | 20 to 80% non-condensing                                                                                        |
| Body dimensions (L x W x H)       | 45 x 46 x 33 mm including connectors, w/o tripod and lens                                                       |
| Mass                              | 85 g                                                                                                            |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                               |
| Software interface standard       | GigE Vision Standard 1.2                                                                                        |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                              |

Table 6: Prosilica GC750/750C camera specifications

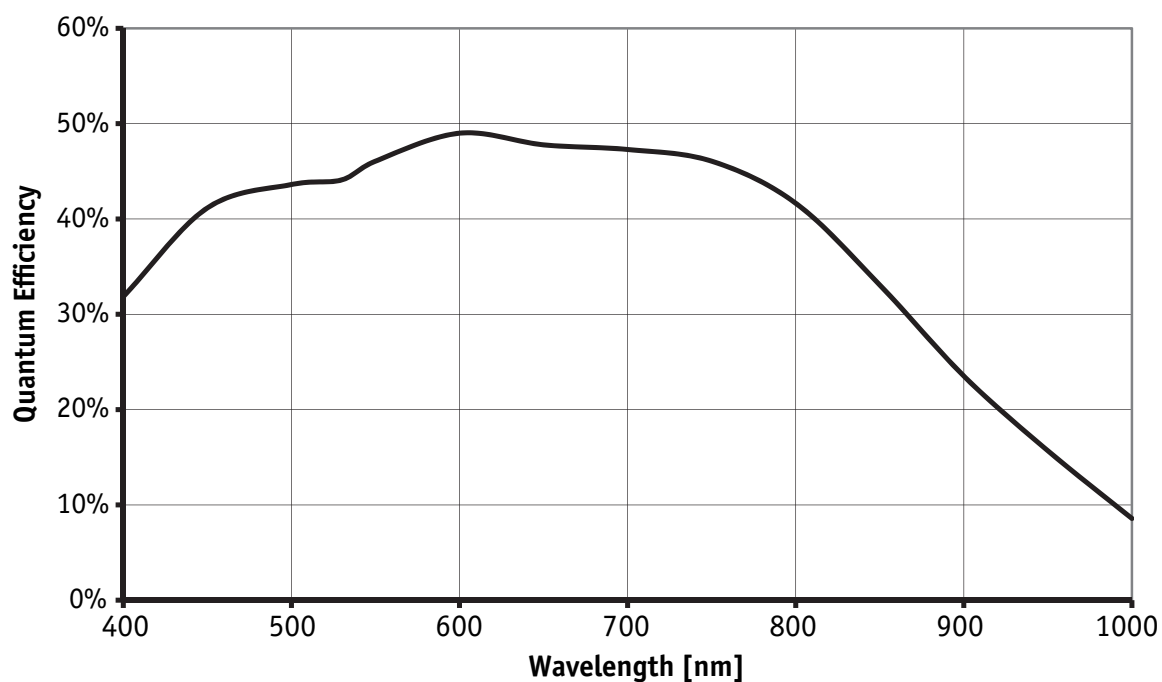


Figure 7: Prosilica GC750 monochrome spectral response

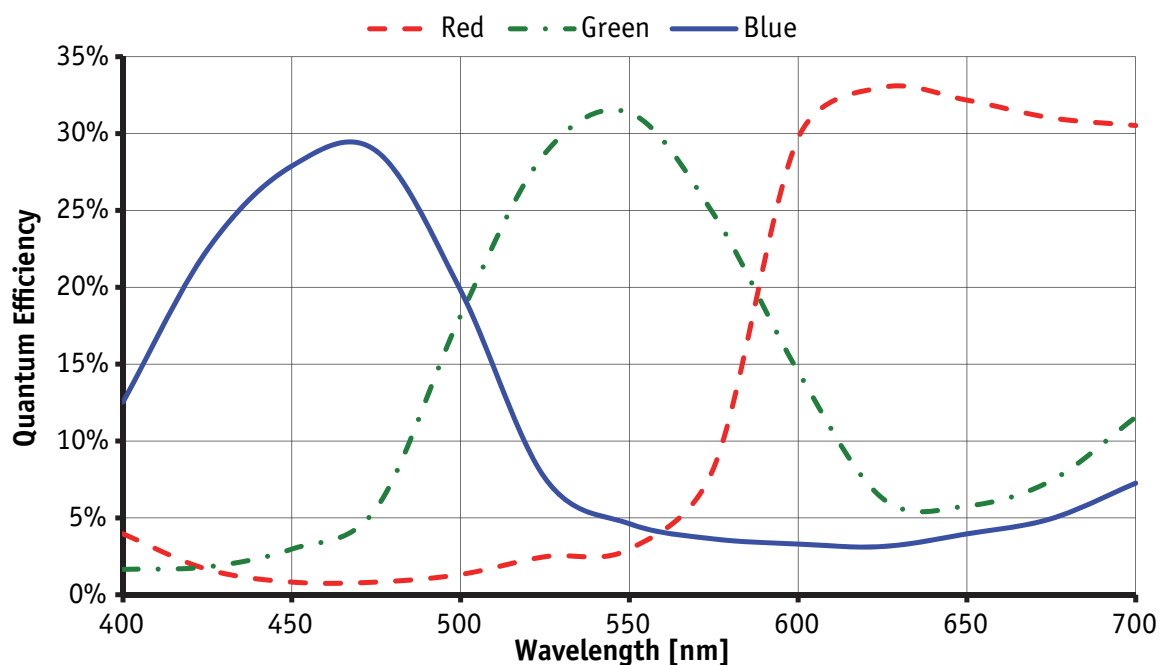


Figure 8: Prosilica GC750C color spectral response (without IR cut filter)

## Prosilica GC780/780C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 782 x 582                                                                                              |
| Sensor                            | Sony ICX415AL, ICX415AQ for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/2                                                                                               |
| Cell size                         | 8.3 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 64 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC780: Mono8, Mono12, Mono12Packed<br>GC780C: Mono8                                                    |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 8 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                 |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| Gain control                      | GC780: 0 to 26 dB<br>GC780C: 0 to 23 dB                                                                |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 2.8 W @ 12 VDC                                                                                         |
| Trigger latency                   | 1 $\mu\text{s}$ for non-isolated I/O, 2.8 $\mu\text{s}$ for isolated I/O                               |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 100 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 7: Prosilica GC780/780C camera specifications

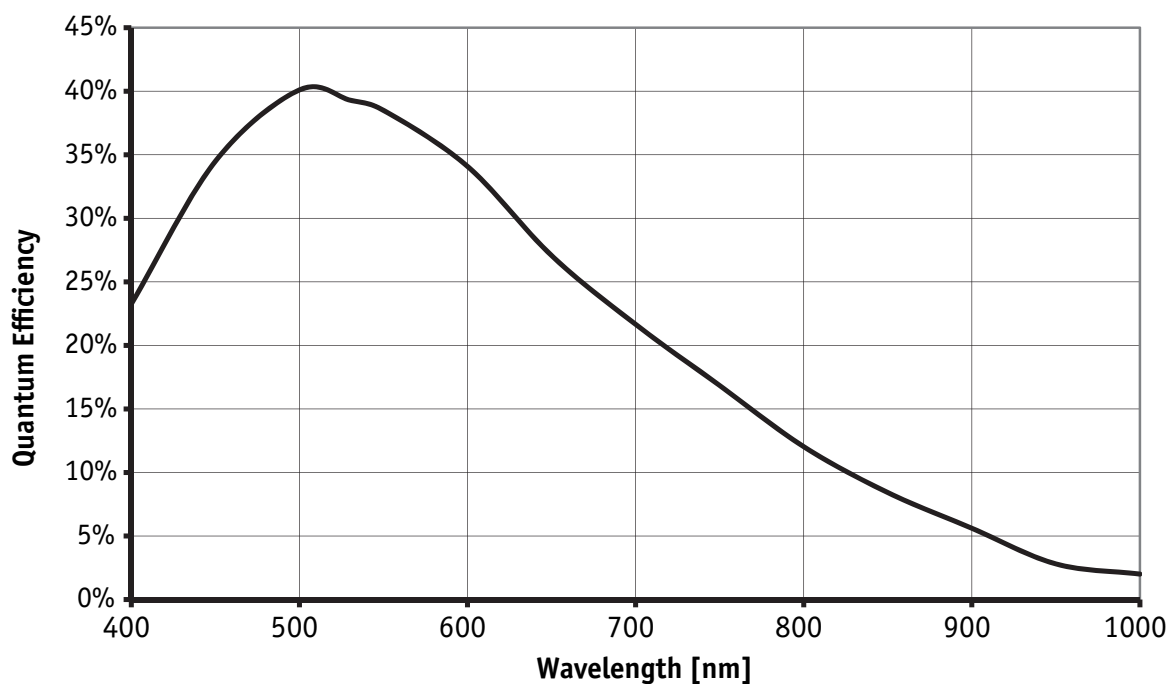


Figure 9: Prosilica GC780 monochrome spectral response

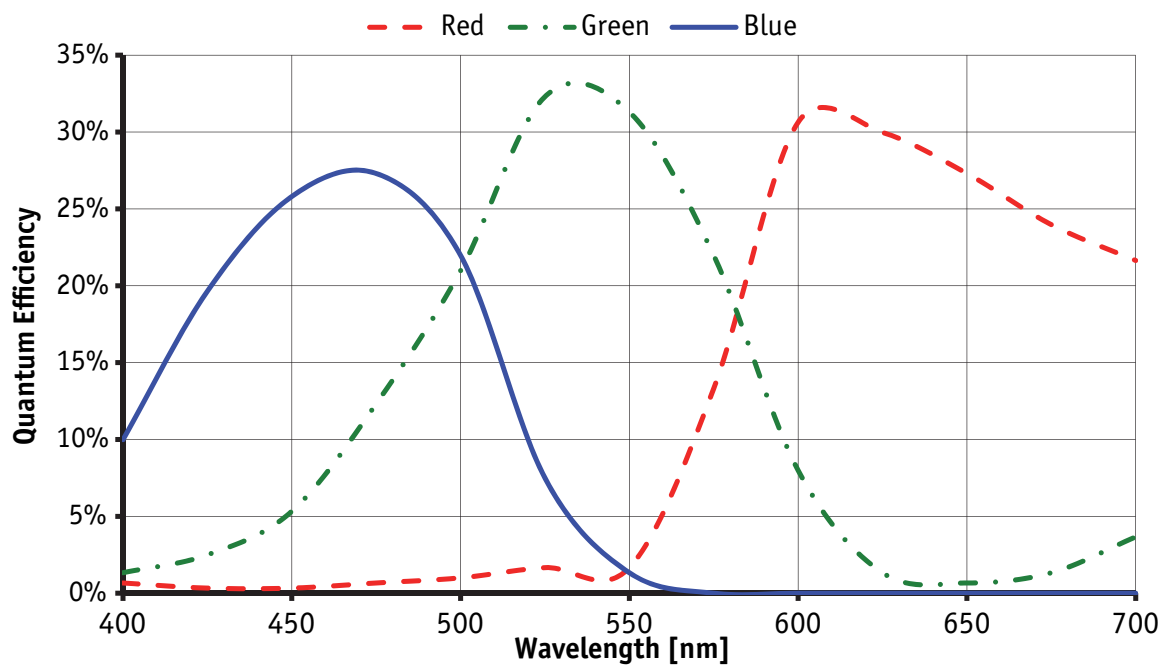


Figure 10: Prosilica GC780C color spectral response (without IR cut filter)

## Prosilica GC1020/1020C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1024 x 768                                                                                             |
| Sensor                            | Sony ICX204AL, ICX204AK for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/3                                                                                               |
| Cell size                         | 4.65 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 33 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1020: Mono8, Mono12, Mono12Packed<br>GC1020C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 22 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 2.9 W @ 12 VDC                                                                                         |
| Trigger latency                   | 2.8 $\mu\text{s}$ for non-isolated I/O, 4.5 $\mu\text{s}$ for isolated I/O                             |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 99 g                                                                                                   |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 8: Prosilica GC1020/1020C camera specifications

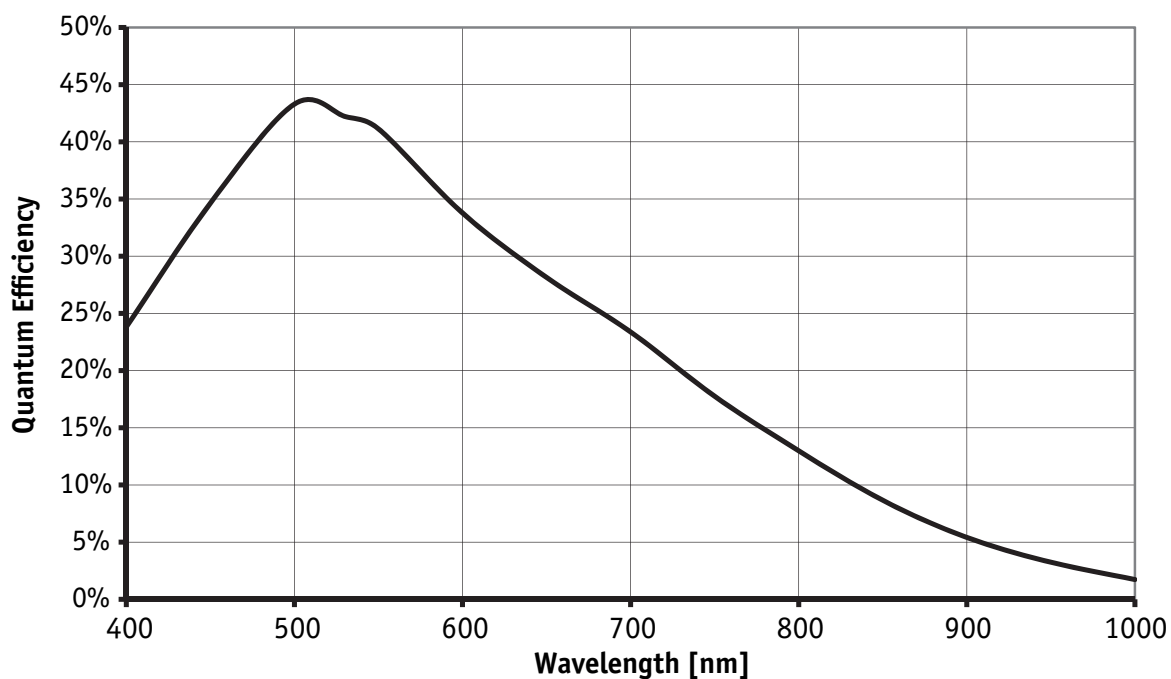


Figure 11: Prosilica GC1020 monochrome spectral response

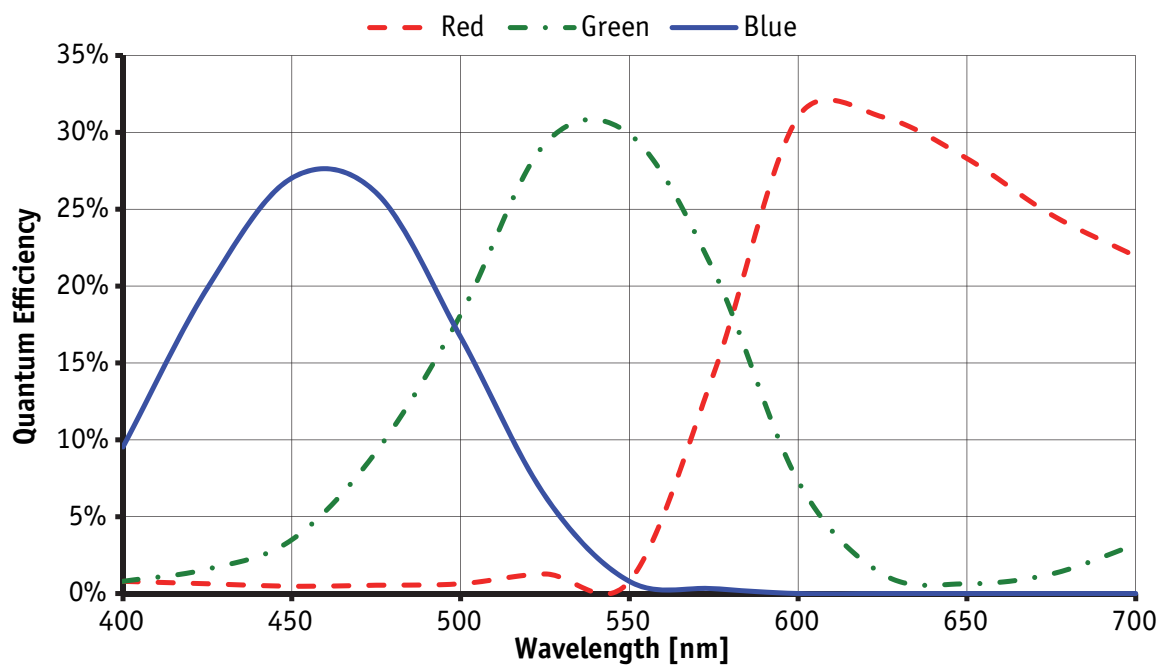


Figure 12: Prosilica GC1020C color spectral response (without IR cut filter)

## Prosilica GC1280

| Feature                           | Specification                                                                |
|-----------------------------------|------------------------------------------------------------------------------|
| Resolution                        | 1280 x 1024                                                                  |
| Sensor                            | Cypress IBIS5B                                                               |
| Type                              | CMOS Progressive                                                             |
| Sensor size                       | Type 2/3                                                                     |
| Cell size                         | 6.7 $\mu\text{m}$                                                            |
| Lens mount                        | C (adjustable)                                                               |
| Max frame rate at full resolution | 27 fps                                                                       |
| A/D                               | 10 bit                                                                       |
| On-board FIFO                     | 16 MB                                                                        |
| Bit depth                         | 8/10                                                                         |
| Mono formats                      | Mono8                                                                        |
| Exposure control                  | 10 $\mu\text{s}$ to 1 s; 1 $\mu\text{s}$ increments                          |
| Gain control                      | 0 to 15 dB                                                                   |
| TTL I/Os                          | 1 input, 1 output                                                            |
| Opto-coupled I/Os                 | 1 input, 1 output                                                            |
| RS-232                            | 1                                                                            |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX |
| Power consumption                 | 2.9 W @ 12 VDC                                                               |
| Trigger latency                   | 2.8 $\mu\text{s}$ for non-isolated I/O, 4.5 $\mu\text{s}$ for isolated I/O   |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O   |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O               |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                       |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                     |
| Operating humidity                | 20 to 80% non-condensing                                                     |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                    |
| Mass                              | 99 g                                                                         |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                            |
| Software interface standard       | GigE Vision Standard 1.2                                                     |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                           |

Table 9: Prosilica GC1280 camera specifications

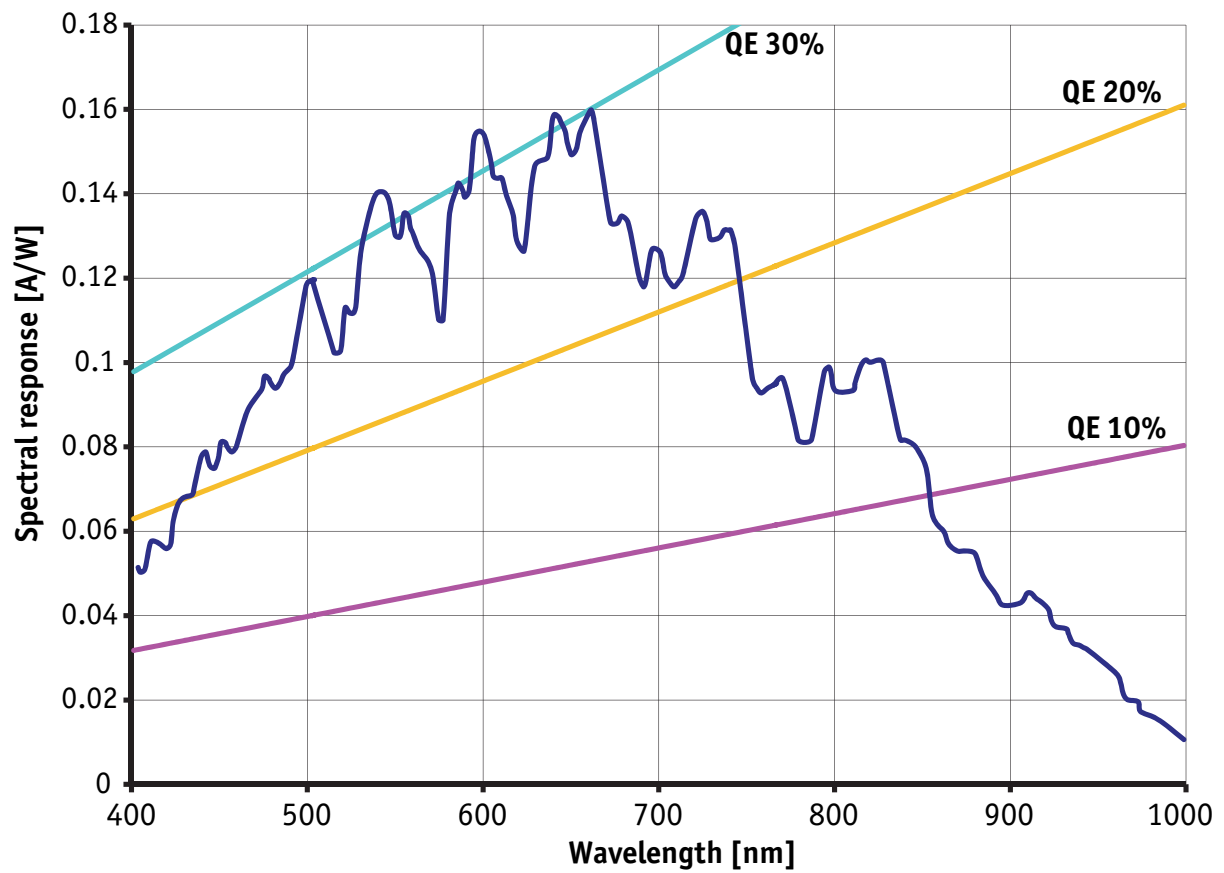


Figure 13: Prosilica GC1280 monochrome spectral response

## Prosilica GC1290/1290C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1280 x 960                                                                                             |
| Sensor                            | Sony ICX445ALA, ICX445AQA for color                                                                    |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/3                                                                                               |
| Cell size                         | 3.75 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 32 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1290: Mono8, Mono12, Mono12Packed<br>GC1290C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 12 $\mu\text{s}$ to 78.5 s; 1 $\mu\text{s}$ increments                                                 |
| Gain control                      | 0 to 24 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3 W @ 12 VDC                                                                                           |
| Trigger latency                   | 2 $\mu\text{s}$ for non-isolated I/O, 10 $\mu\text{s}$ for isolated I/O                                |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 106 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 10: Prosilica GC1290/1290C camera specifications

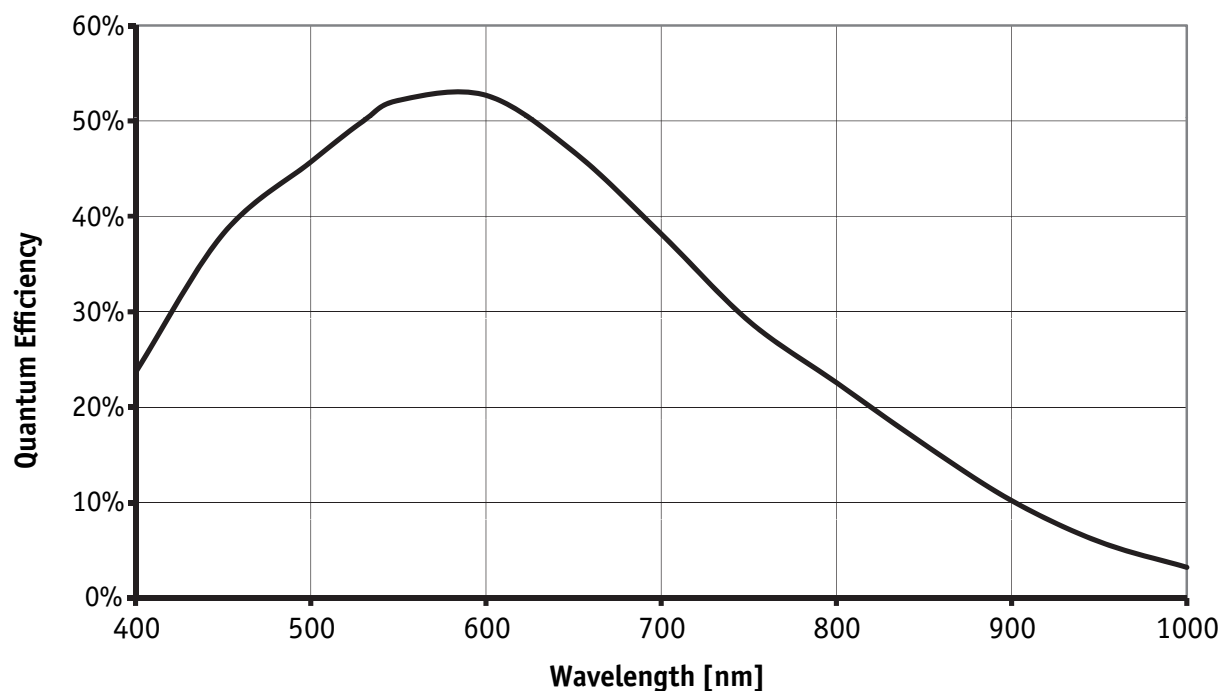


Figure 14: Prosilica GC1290 monochrome spectral response

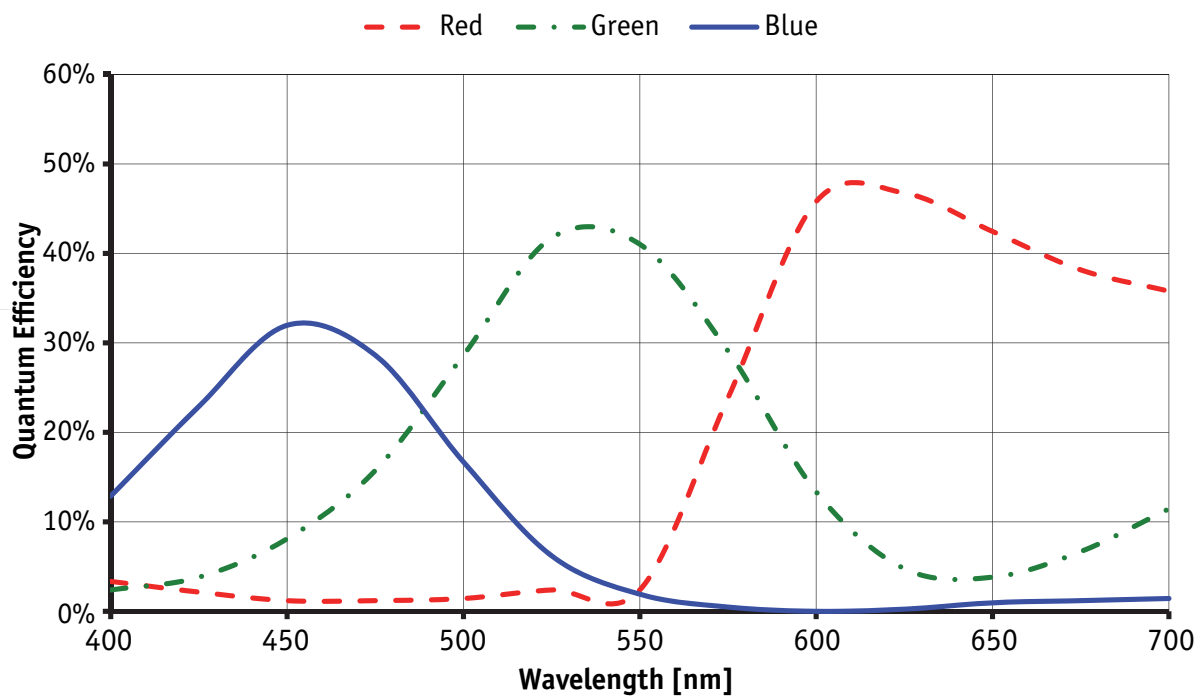


Figure 15: Prosilica GC1290C color spectral response (without IR cut filter)

## Prosilica GC1350/1350C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1360 x 1024                                                                                            |
| Sensor                            | Sony ICX205AL, Sony ICX205AK for color                                                                 |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/2                                                                                               |
| Cell size                         | 4.65 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable) / CS                                                                                    |
| Max frame rate at full resolution | 20 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1350: Mono8, Mono12, Mono12Packed<br>GC1350C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 12 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 25 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3 W @ 12 VDC                                                                                           |
| Trigger latency                   | 3.5 $\mu\text{s}$ for non-isolated I/O, 5 $\mu\text{s}$ for isolated I/O                               |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 100 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 11: Prosilica GC1350/1350C camera specifications

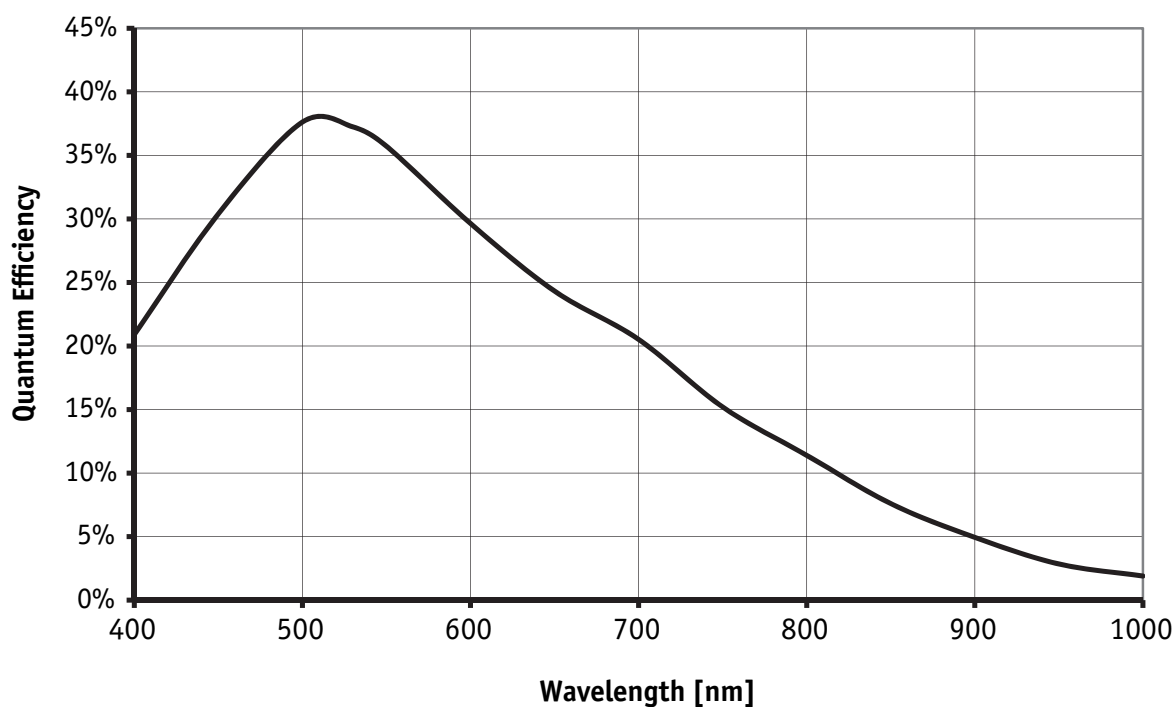


Figure 16: Prosilica GC1350 monochrome spectral response

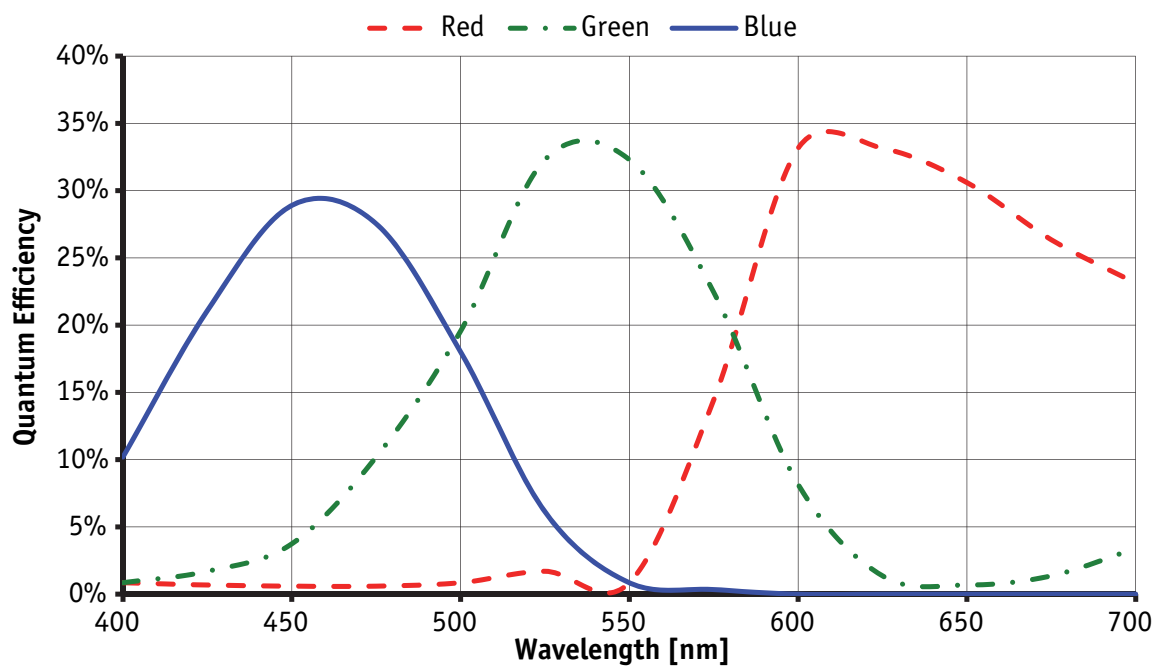


Figure 17: Prosilica GC1350C color spectral response (without IR cut filter)

## Prosilica GC1380/1380C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1360 x 1024                                                                                            |
| Sensor                            | Sony ICX285AL, Sony ICX285AQ for color                                                                 |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 2/3                                                                                               |
| Cell size                         | 6.45 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 20.2 fps                                                                                               |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1380: Mono8, Mono12, Mono12Packed<br>GC1380C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 27 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to full resolution                                                                                   |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.3 W @ 12 VDC                                                                                         |
| Trigger latency                   | 3.7 $\mu\text{s}$ for non-isolated I/O, 5 $\mu\text{s}$ for isolated I/O                               |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 104 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 12: Prosilica GC1380/1380C camera specifications

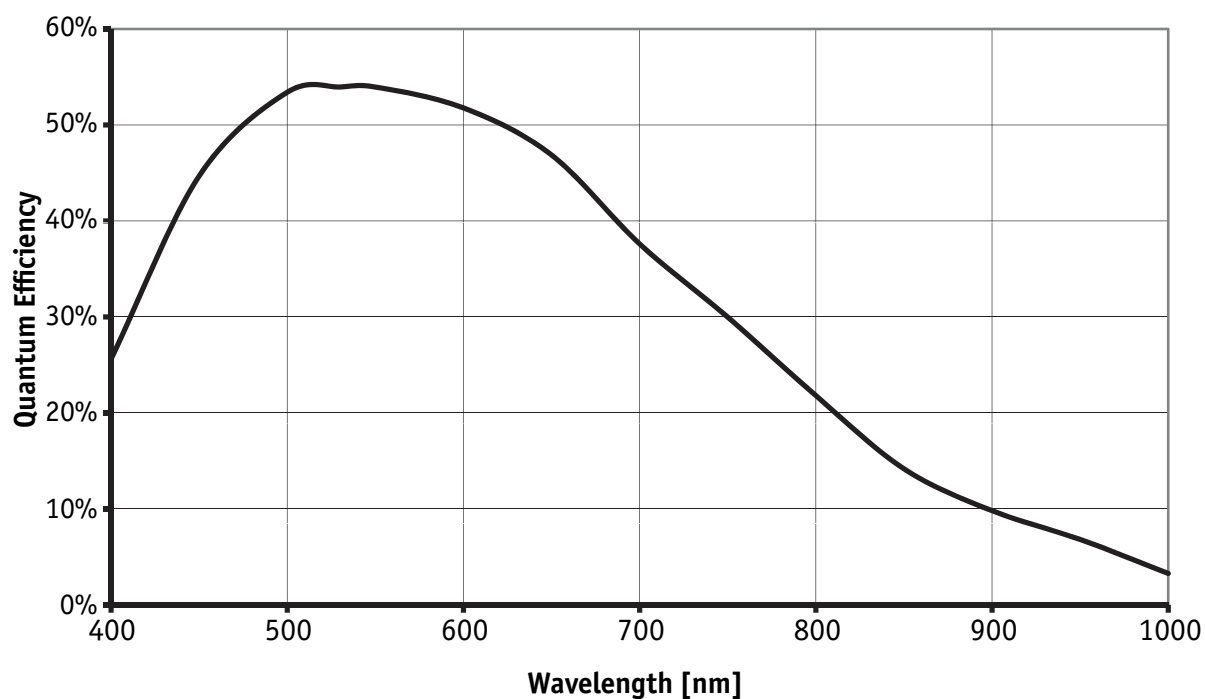


Figure 18: Prosilica GC1380 monochrome spectral response

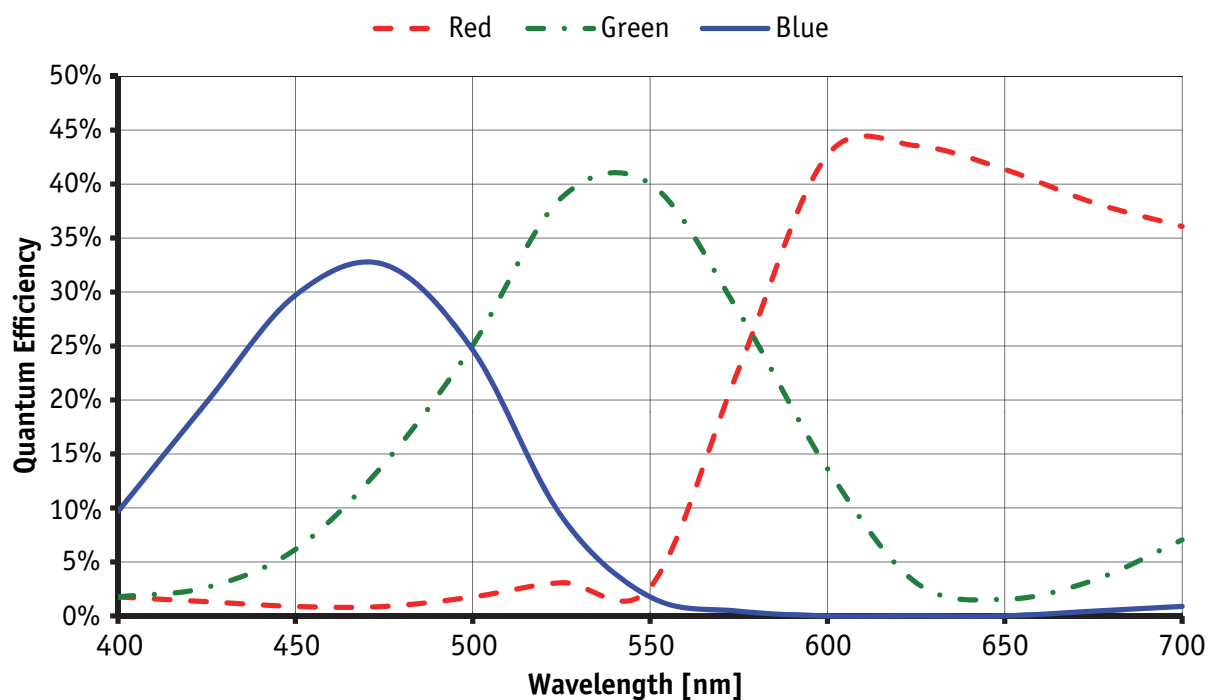


Figure 19: Prosilica GC1380C color spectral response (without IR cut filter)

## Prosilica GC1380H/1380CH

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1360 x 1024                                                                                            |
| Sensor                            | Sony ICX285AL, Sony ICX285AQ for color                                                                 |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 2/3                                                                                               |
| Cell size                         | 6.45 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 30 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1380H: Mono8, Mono12, Mono12Packed<br>GC1380CH: Mono8                                                |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 78.5 s; 1 $\mu\text{s}$ increments                                                 |
| Gain control                      | 0 to 33 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.3 W @ 12 VDC                                                                                         |
| Trigger latency                   | 2 $\mu\text{s}$ for non-isolated I/O, 10 $\mu\text{s}$ for isolated I/O                                |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 111 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 13: Prosilica GC1380H/1380CH camera specifications

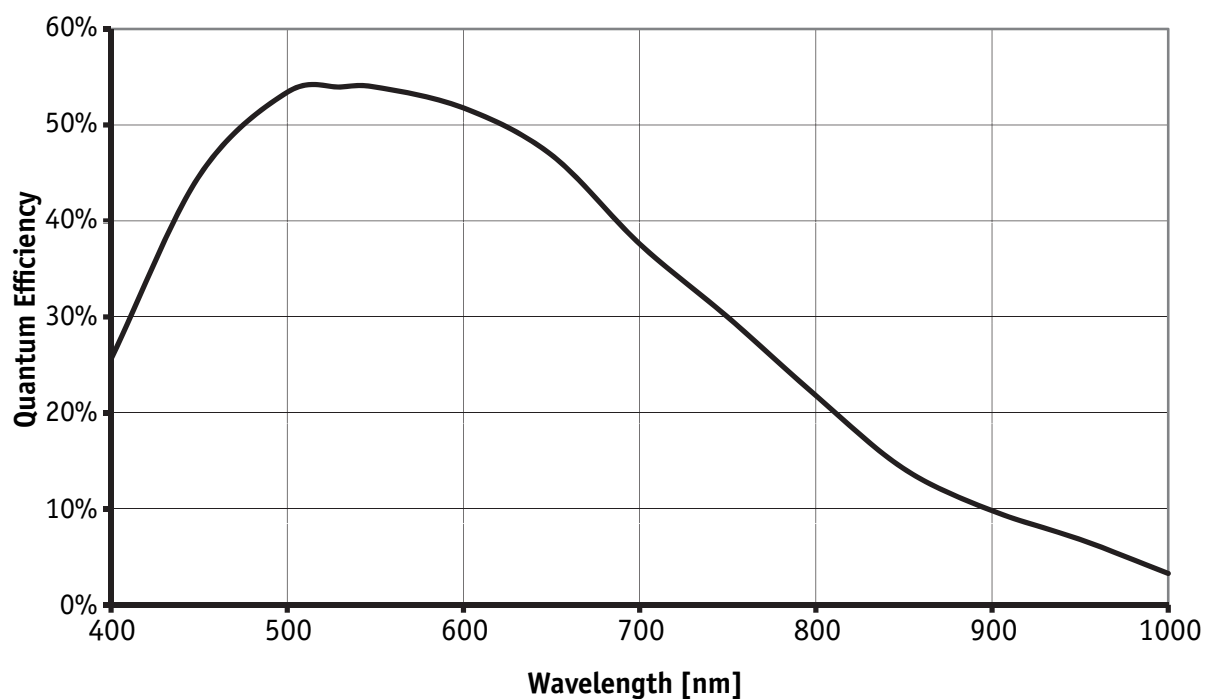


Figure 20: Prosilica GC1380H monochrome spectral response

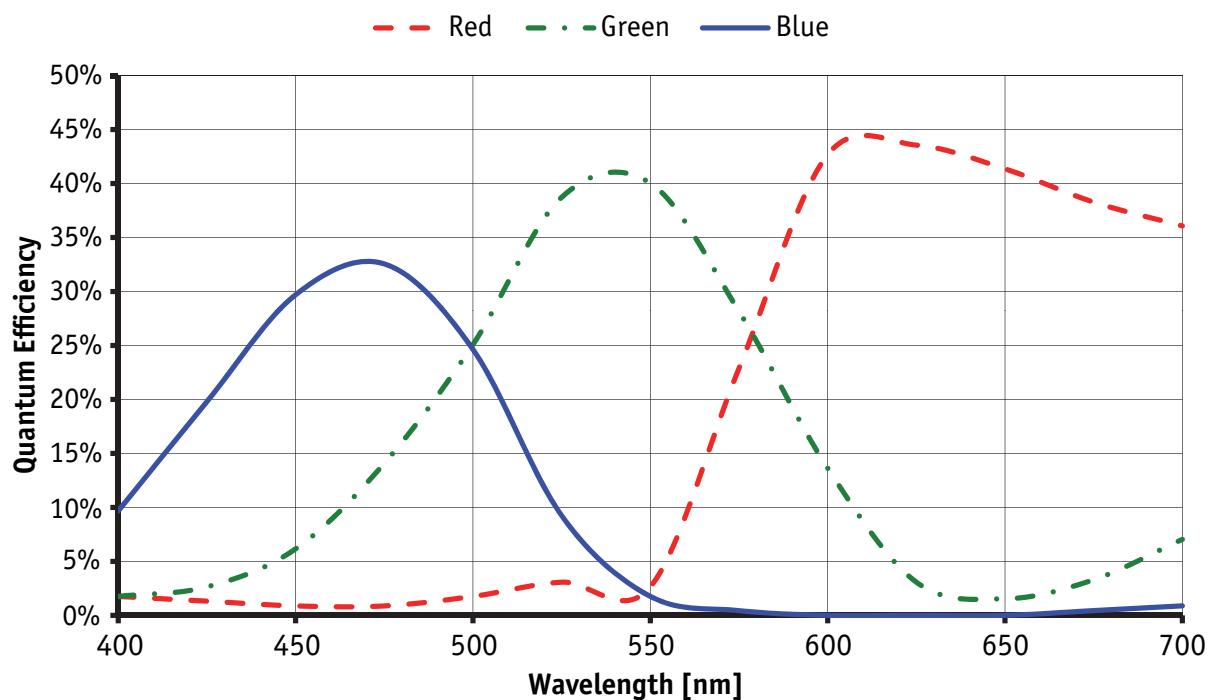


Figure 21: Prosilica GC1380CH color spectral response (without IR cut filter)

## Prosilica GC1600/1600C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1620 x 1220                                                                                            |
| Sensor                            | Sony ICX274AL, ICX274AQ for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/1.8                                                                                             |
| Cell size                         | 4.4 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 15 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1600: Mono8, Mono12, Mono12Packed<br>GC1600C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 116.8 s; 1 $\mu\text{s}$ increments                                                |
| Gain control                      | 0 to 21 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.3 W @ 12 VDC                                                                                         |
| Trigger latency                   | 2.3 $\mu\text{s}$ for non-isolated I/O, 4 $\mu\text{s}$ for isolated I/O                               |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 10 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 97 g                                                                                                   |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 14: Prosilica GC1600/1600C camera specifications

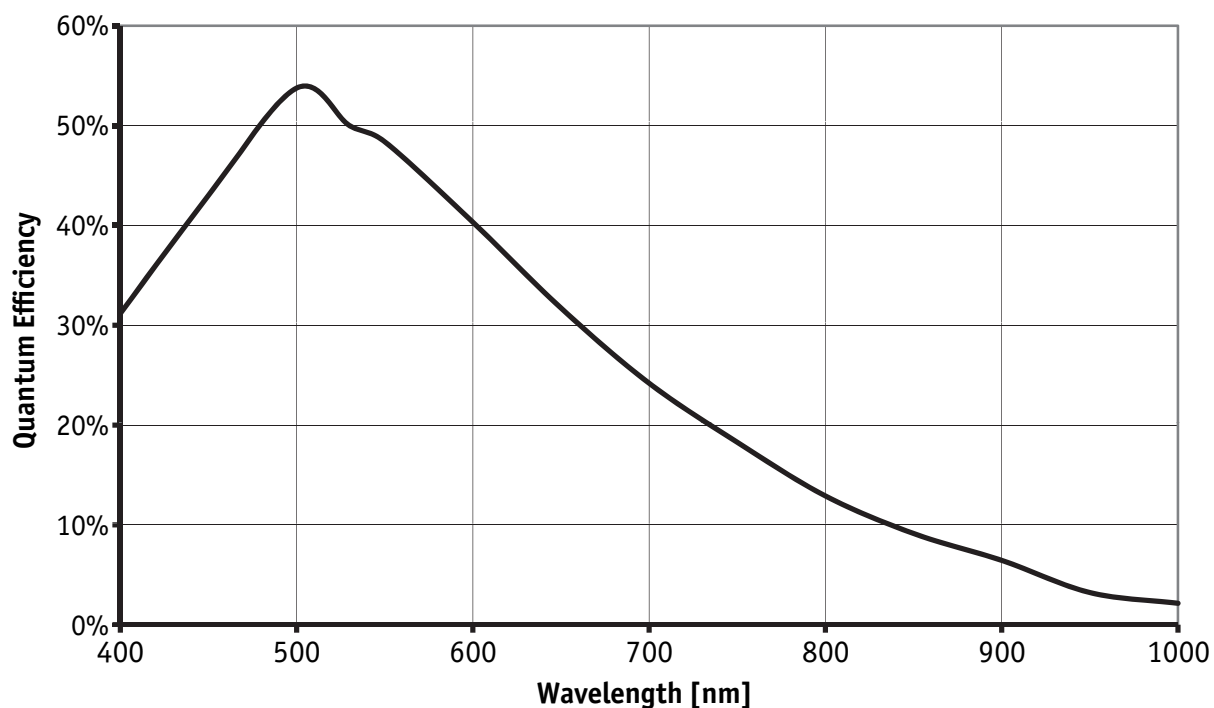


Figure 22: Prosilica GC1600 monochrome spectral response

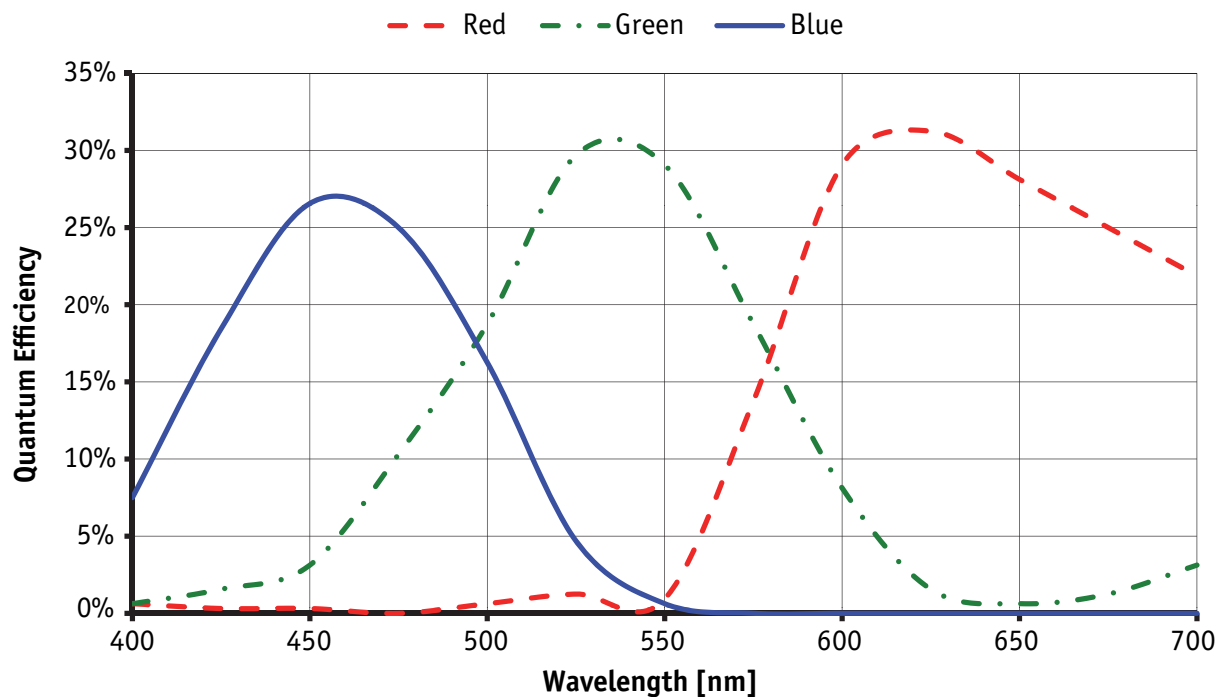


Figure 23: Prosilica GC1600C color spectral response (without IR cut filter)

## Prosilica GC1600H/1600CH

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 1620 x 1220                                                                                            |
| Sensor                            | Sony ICX274AL, ICX274AQ for color                                                                      |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 1/1.8                                                                                             |
| Cell size                         | 4.4 $\mu\text{m}$                                                                                      |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 25 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC1600H: Mono8, Mono12, Mono12Packed<br>GC1600CH: Mono8                                                |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 68.7 s; 1 $\mu\text{s}$ increments                                                 |
| Gain control                      | 0 to 32 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.3 W @ 12 VDC                                                                                         |
| Trigger latency                   | 2 $\mu\text{s}$ for non-isolated I/O, 10 $\mu\text{s}$ for isolated I/O                                |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 20 ns for non-isolated I/O, 0.5 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +50 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 105 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 15: Prosilica GC1600H/1600CH camera specifications

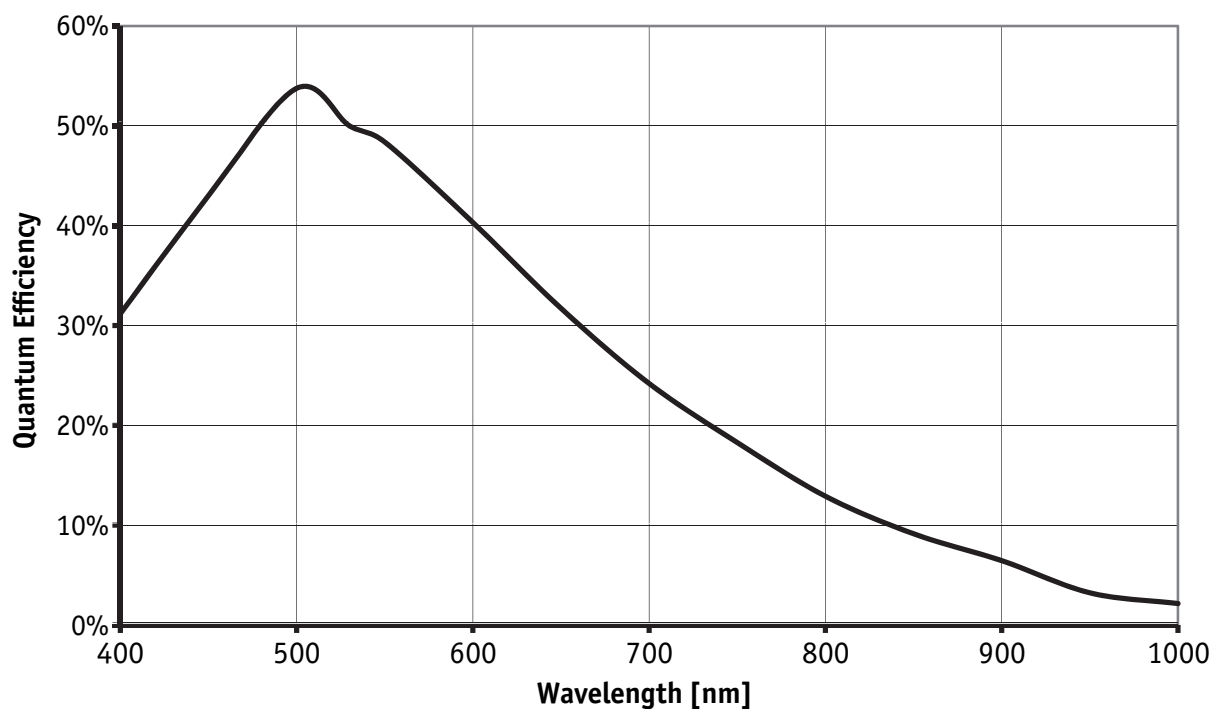


Figure 24: Prosilica GC1600H monochrome spectral response

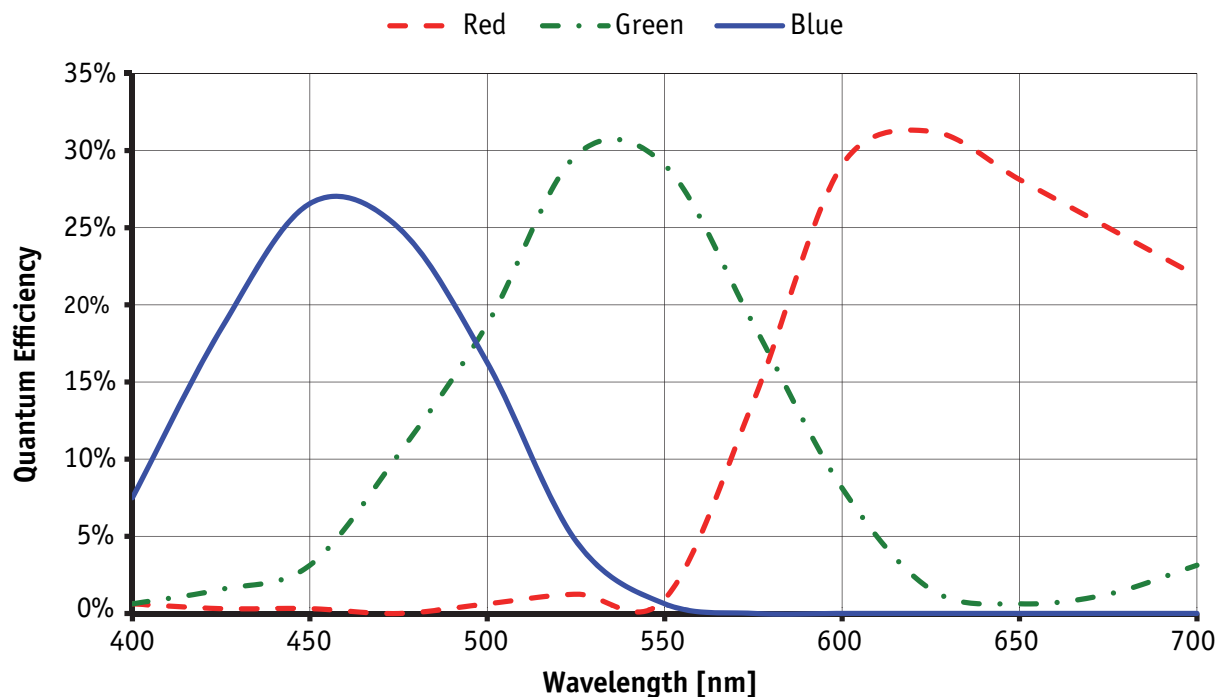


Figure 25: Prosilica GC1600CH color spectral response (without IR cut filter)

## Prosilica GC2450/2450C

| Feature                           | Specification                                                                                          |
|-----------------------------------|--------------------------------------------------------------------------------------------------------|
| Resolution                        | 2448 x 2050                                                                                            |
| Sensor                            | Sony ICX625ALA, Sony ICX625AQA for color                                                               |
| Type                              | CCD Progressive                                                                                        |
| Sensor size                       | Type 2/3                                                                                               |
| Cell size                         | 3.45 $\mu\text{m}$                                                                                     |
| Lens mount                        | C (adjustable)                                                                                         |
| Max frame rate at full resolution | 15 fps                                                                                                 |
| A/D                               | 12 bit                                                                                                 |
| On-board FIFO                     | 16 MB                                                                                                  |
| Bit depth                         | 8/12                                                                                                   |
| Mono formats                      | GC2450: Mono8, Mono12, Mono12Packed<br>GC2450C: Mono8                                                  |
| Color formats                     | BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed |
| Exposure control                  | 10 $\mu\text{s}$ to 42.9 s; 1 $\mu\text{s}$ increments                                                 |
| Gain control                      | 0 to 32 dB                                                                                             |
| Horizontal binning                | 1 to 8 pixels                                                                                          |
| Vertical binning                  | 1 to 14 rows                                                                                           |
| TTL I/Os                          | 1 input, 1 output                                                                                      |
| Opto-coupled I/Os                 | 1 input, 1 output                                                                                      |
| RS-232                            | 1                                                                                                      |
| Power requirements                | 5–16 VDC: Cameras SN: 02-XXXXX-0XXXX<br>5–25 VDC: Cameras SN: 02-XXXXX-1XXXX                           |
| Power consumption                 | 3.8 W @ 12 VDC                                                                                         |
| Trigger latency                   | 2 $\mu\text{s}$ for non-isolated I/O, 10 $\mu\text{s}$ for isolated I/O                                |
| Trigger jitter                    | $\pm 20$ ns for non-isolated I/O, $\pm 0.5$ $\mu\text{s}$ for isolated I/O                             |
| Tpd                               | 20 ns for non-isolated I/O, 1.3 $\mu\text{s}$ for isolated I/O                                         |
| Operating temperature             | 0 to +40 °C ambient temperature (without condensation)                                                 |
| Storage temperature               | -10 to +70 °C ambient temperature (without condensation)                                               |
| Operating humidity                | 20 to 80% non-condensing                                                                               |
| Body dimensions (L x W x H)       | 59 x 46 x 33 mm including connectors, w/o tripod and lens                                              |
| Mass                              | 106 g                                                                                                  |
| Hardware interface standard       | IEEE 802.3 1000BASE-T, 100BASE-TX                                                                      |
| Software interface standard       | GigE Vision Standard 1.2                                                                               |
| Regulatory                        | CE, FCC Class A, RoHS (2011/65/EU)                                                                     |

Table 16: Prosilica GC2450/2450C camera specifications

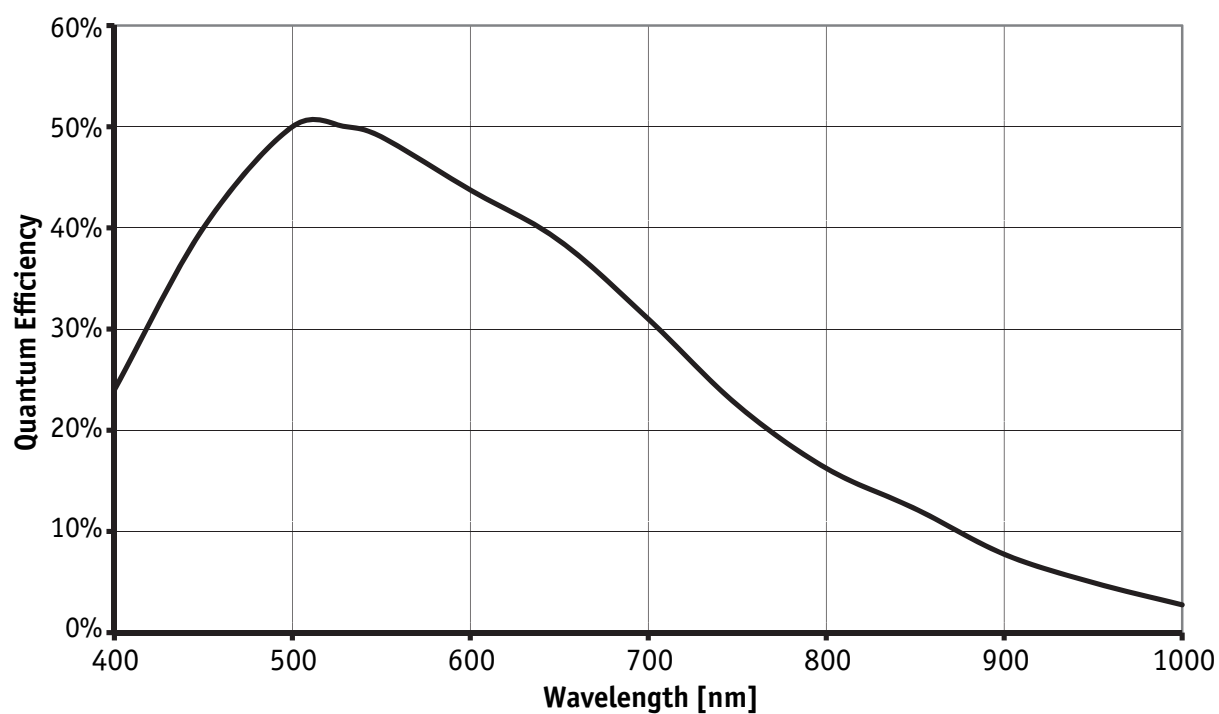


Figure 26: Prosilica GC2450 monochrome spectral response

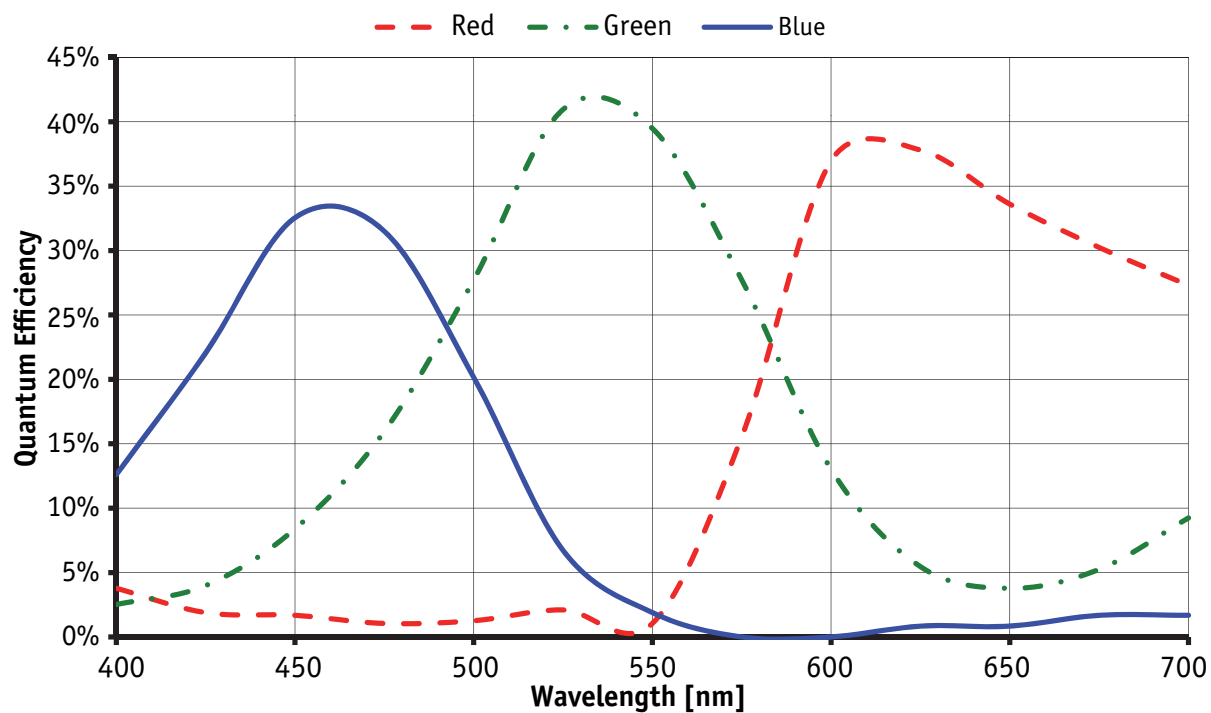


Figure 27: Prosilica GC2450C color spectral response (without IR cut filter)

## Camera attribute highlights

AVT cameras support a number of standard and extended features. The table below identifies a selection of interesting capabilities of the Prosilica GC camera family.

**www**

A complete listing of camera controls, including control definitions can be found online:



**PvAPI users:** [AVT GigE Camera and Driver Attributes](#) document

**VIMBA users:** [AVT GigE Camera and Driver Features](#) document

| Control                                 | Description                                                                                               |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Gain control                            | Manual and auto                                                                                           |
| Exposure control                        | Manual and auto                                                                                           |
| White balance                           | Red and blue channel; manual and auto control                                                             |
| External trigger event                  | Rising edge, falling edge, any edge, level high, level low                                                |
| External trigger delay                  | 0 to 60* s; 1 $\mu$ s increments                                                                          |
| Fixed rate control                      | 0.001 fps to maximum frame rate                                                                           |
| Imaging modes                           | Free-running, external trigger, fixed rate, software trigger                                              |
| Sync out modes                          | Trigger ready, trigger input, exposing, readout, imaging, strobe, GPO                                     |
| Region of interest                      | Independent x and y control with 1 pixel resolution                                                       |
| Multicast                               | Streaming to multiple computers                                                                           |
| Event channel                           | In-camera events including exposure start and trigger are asynchronously broadcasted to the host computer |
| Chunk data                              | Captured images are bundled with attribute information such as exposure and gain value                    |
| Color matrix                            | Correct color rendering for specific color temperature                                                    |
| Gamma, Hue, Saturation                  | Adjust image gamma, hue and saturation                                                                    |
| Precision Time Protocol IEEE1588        | Synchronize clocks of multiple cameras using multicast messaging                                          |
| Lens control                            | Control P-iris lenses                                                                                     |
| *May vary depending on the camera model |                                                                                                           |

Table 17: Prosilica GC camera and driver attribute highlights

## Filter

All Prosilica GC color models are equipped with an infrared block filter (IR filter). This filter is employed to prevent infrared wavelength photons from passing to the sensor. In the absence of IR filter, images are dominated by red and incapable of being properly color balanced. Monochrome cameras do not employ an IR filter.

The figure below shows the filter transmission response for the IRC30 filter employed in the Prosilica GC cameras.

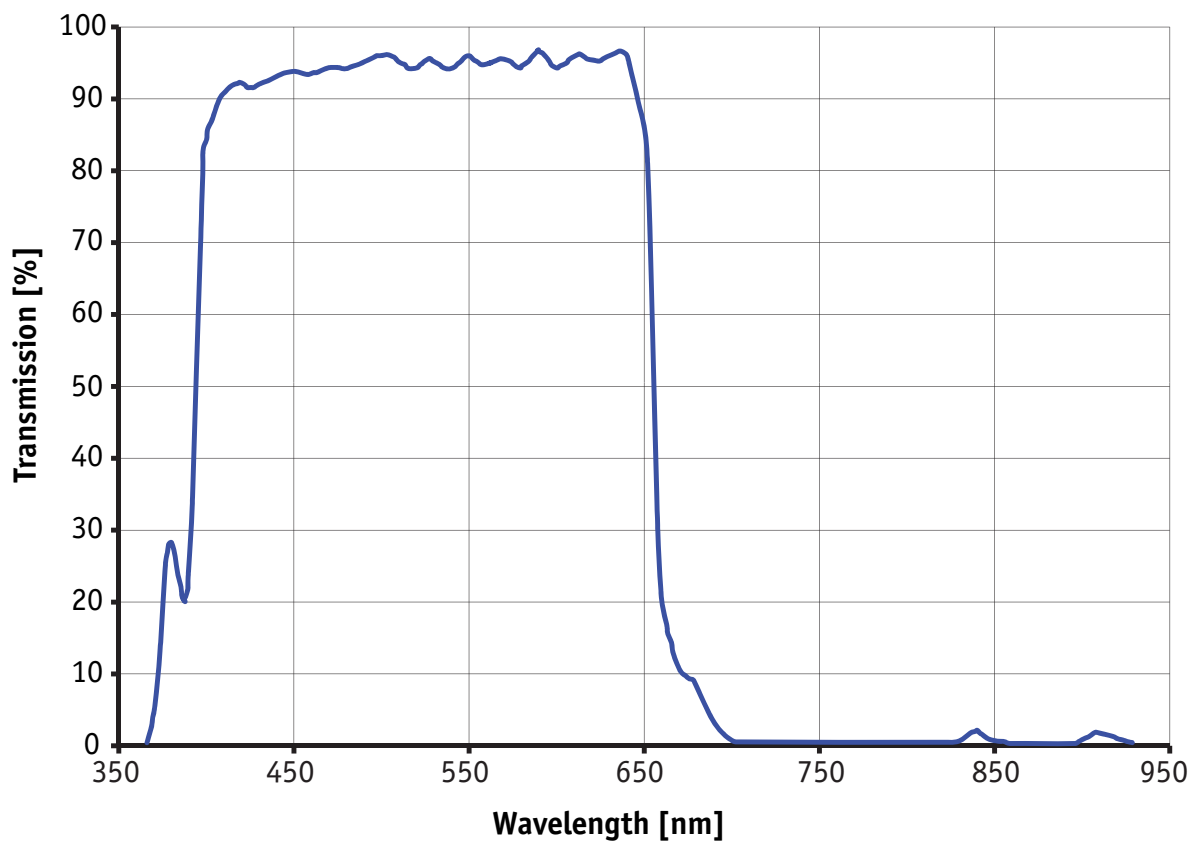


Figure 28: IRC30 filter transmission response

## Camera dimensions

The Prosilica GC family offers both CCD and CMOS sensor models. CCD cameras utilize additional circuitry required for A/D conversion. As a result, CMOS models offer a shorter mechanical package than CCD models.

### Prosilica GC750, GC1280

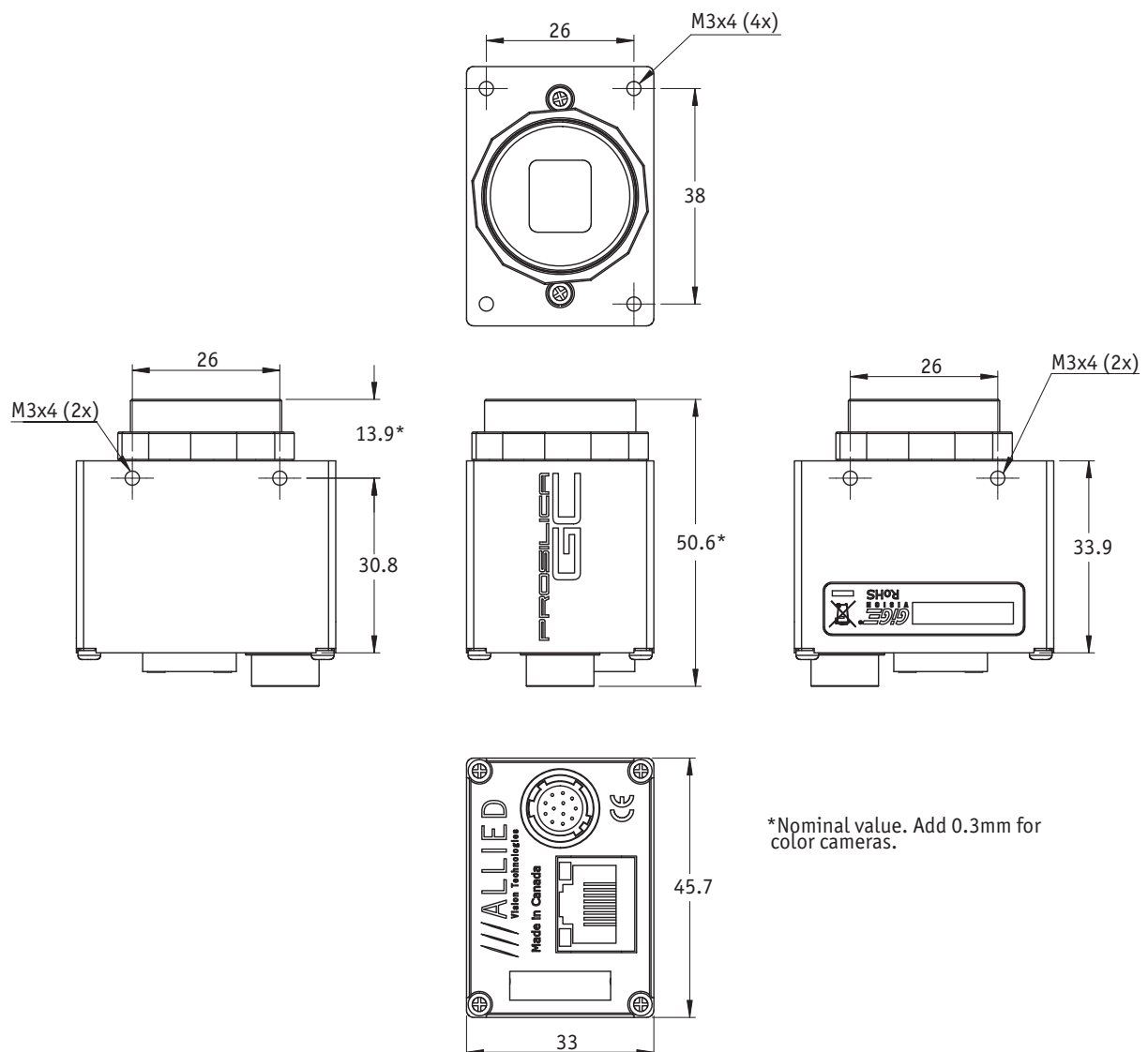


Figure 29: Mechanical dimensions for Prosilica GC750, and GC1280

## Prosilica GC CCD models:

GC650/C, GC655/C, GC660/C, GC780C, GC1020/C, GC1290/C, GC1350/C,  
GC1380/C, GC1380H/C, GC1600/C, GC1600H/C, GC2450/C

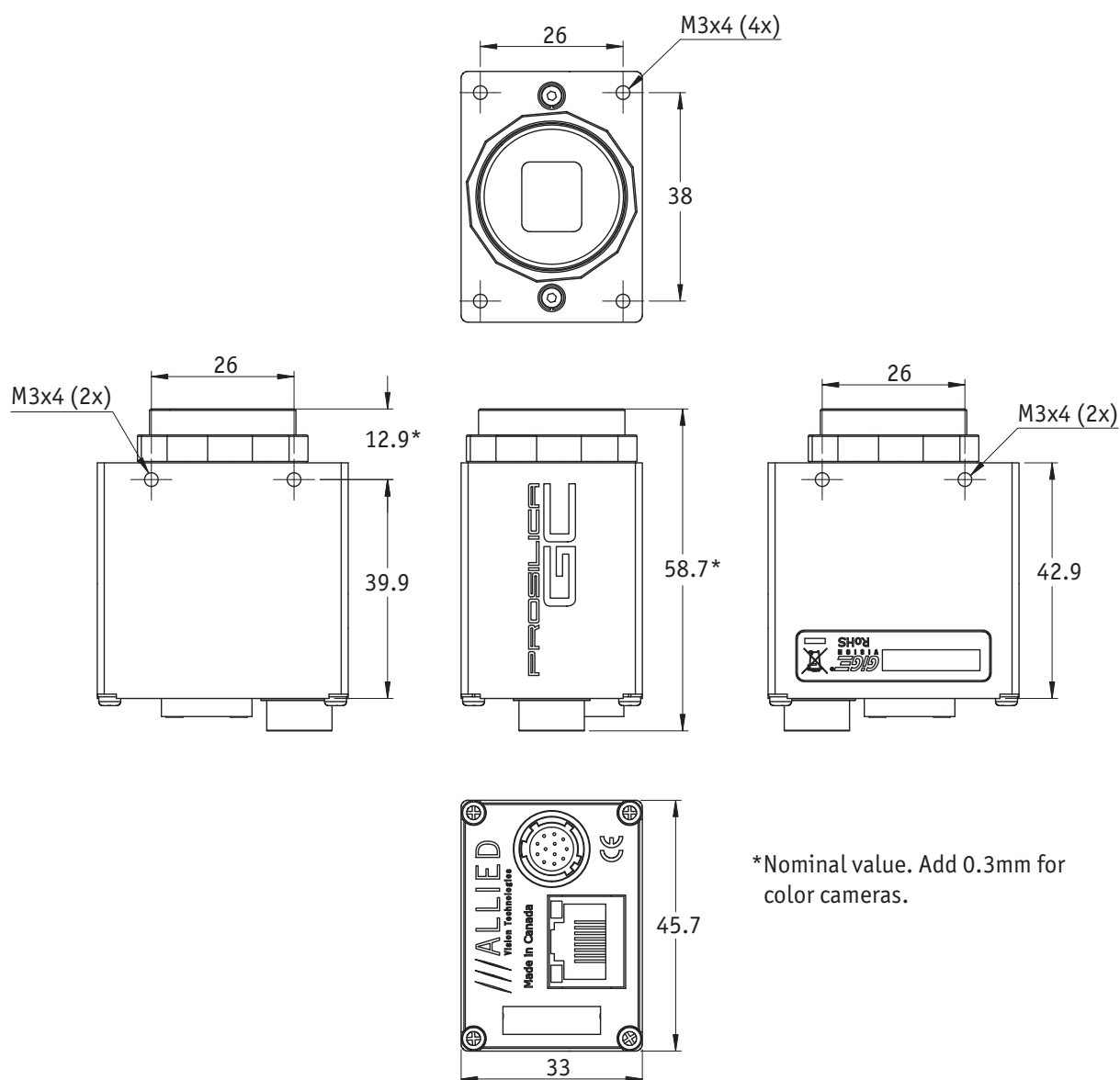


Figure 30: Prosilica GC CCD models mechanical dimensions

## Tripod adapter

A **Prosilica GC** camera can be mounted on a camera tripod by using mounting plate P/N 02-5002A. The same mounting plate can be used for all models within the GC camera family.

**Note** Contact your AVT sales representative to purchase GC mounting plate 02-5002A.

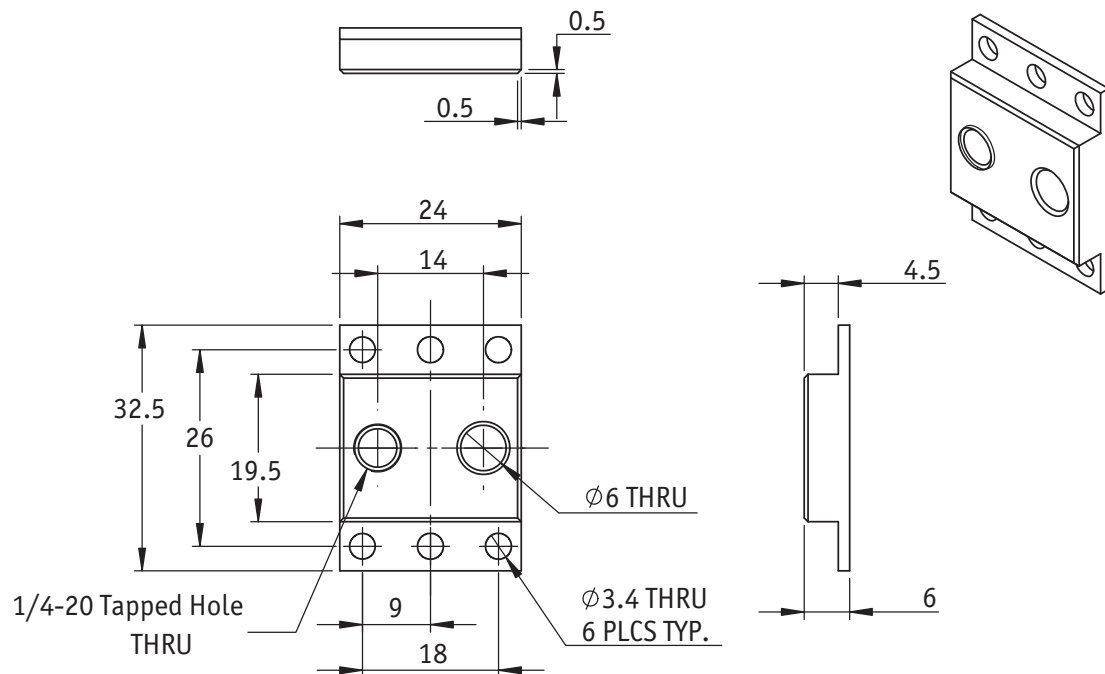


Figure 31: Prosilica GC tripod mount mechanical drawing

## Optical flange focal distance

Optical flange focal distance is the optical distance from the mounting flange to the image sensor die (see figure 32 and table 18). Optical flange focal distance can be calculated as:

$$\text{Optical flange focal distance} \approx \text{Flange focal distance} - \left( \frac{\text{IR cut filter thickness} + \text{Sensor window thickness}}{3} \right)$$

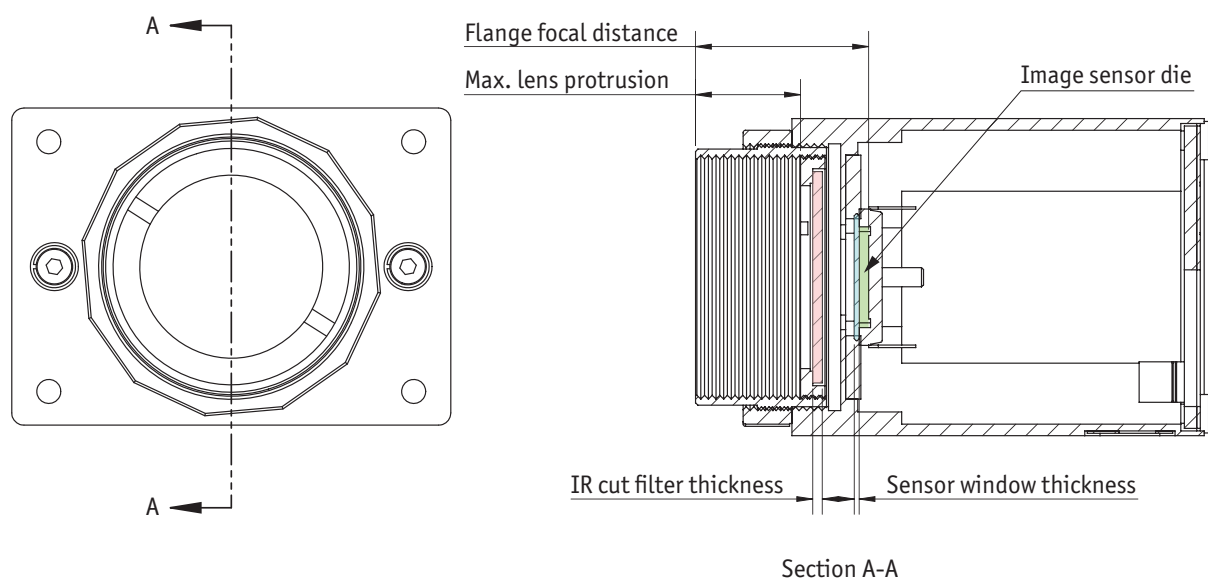


Figure 32: Cross section of typical Prosilica GC assembly with C-Mount

| Camera  | Mount    | Maximum Lens protrusion [mm] | IR cut filter* [mm] | Sensor window [mm] | Nominal Flange focal distance [mm] |
|---------|----------|------------------------------|---------------------|--------------------|------------------------------------|
| GC650   | C-Mount  | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC650C  | C-Mount  | 9.01                         | 1.00                | 0.75               | 18.11                              |
| GC655   | C-Mount  | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC655C  | C-Mount  | 8.29                         | 1.00                | 0.75               | 18.11                              |
| GC660   | C-Mount  | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC660C  | C-Mount  | 11.01                        | 1.00                | 0.75               | 18.11                              |
| GC750   | CS-Mount | 9.12                         | 0.00                | 0.40               | 12.63                              |
| GC750C  | CS-Mount | 3.84                         | 1.00                | 0.40               | 12.97                              |
| GC780   | C-Mount  | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC780C  | C-Mount  | 8.29                         | 1.00                | 0.75               | 18.11                              |
| GC1020  | C-Mount  | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC1020C | C-Mount  | 9.01                         | 1.00                | 0.75               | 18.11                              |

Table 18: Flange focal distance and maximum lens protrusion for Prosilica GC cameras

| Camera                                                      | Mount   | Maximum Lens protrusion [mm] | IR cut filter* [mm] | Sensor window [mm] | Nominal Flange focal distance [mm] |
|-------------------------------------------------------------|---------|------------------------------|---------------------|--------------------|------------------------------------|
| GC1290                                                      | C-Mount | 13.64                        | 0.00                | 0.50               | 17.69                              |
| GC1290C                                                     | C-Mount | 12.20                        | 1.00                | 0.50               | 18.03                              |
| GC1350                                                      | C-Mount | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC1350C                                                     | C-Mount | 8.90                         | 1.00                | 0.75               | 18.11                              |
| GC1380                                                      | C-Mount | 13.65                        | 0.00                | 0.75               | 17.78                              |
| GC1380C                                                     | C-Mount | 8.95                         | 1.00                | 0.75               | 18.11                              |
| GC1380H                                                     | C-Mount | 13.64                        | 0.00                | 0.50               | 17.69                              |
| GC1380CH                                                    | C-Mount | 8.31                         | 1.00                | 0.75               | 18.11                              |
| GC1600                                                      | C-Mount | 13.64                        | 0.00                | 0.75               | 17.78                              |
| GC1600C                                                     | C-Mount | 8.93                         | 1.00                | 0.50               | 18.03                              |
| GC1600CH                                                    | C-Mount | 6.98                         | 1.00                | 0.50               | 18.03                              |
| GC1600H                                                     | C-Mount | 13.64                        | 0.00                | 0.50               | 17.69                              |
| GC2450                                                      | C-Mount | 13.64                        | 0.00                | 0.50               | 17.69                              |
| GC2450C                                                     | C-Mount | 10.93                        | 1.00                | 0.50               | 18.03                              |
| * Only color camera models are equipped with IR cut filter. |         |                              |                     |                    |                                    |

Table 18: Flange focal distance and maximum lens protrusion for Prosilica GC cameras

## Adjustment of C/CS-Mount

**www**



Cameras are shipped with adjustable C-Mount or CS-Mount depending on sensor size and camera order code. See **AVT Modular Concept** for more information:

<http://www.alliedvisiontec.com/us/support/downloads/product-literature/avt-modular-concept.html>

The C-Mount or CS-Mount is adjusted at the factory and should not require adjusting. If for some reason the lens mount requires adjustment, use the following method.

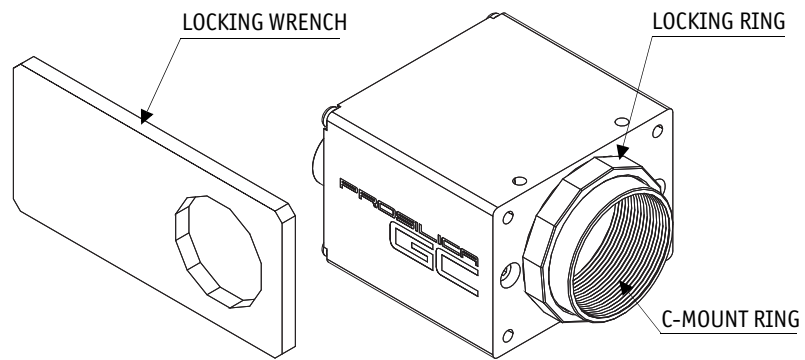


Figure 33: Prosilica GC camera and locking wrench

### Loosen locking ring

Use an adjustable wrench to loosen the locking ring. Be careful not to scratch the camera. When the locking ring is loose, unthread the ring a few turns from the camera face.

#### Note

A wrench suitable for this procedure is available for purchase from AVT.

AVT P/N: 02-5003A



### Image to infinity

Use a C-Mount compatible lens (CS-Mount compatible lens, if using CS ring) that allows an infinity focus. Set the lens to infinity and image a distant object—10 to 15 m should suffice. Make sure the lens is firmly threaded onto the C-Mount ring. Rotate the lens and C-Mount ring until the image is focused. Carefully tighten the locking ring and recheck focus.

## Camera interfaces

This chapter provides information on Gigabit Ethernet port, inputs and outputs, and trigger features.

www



For more information on GigE accessories:

<http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html>

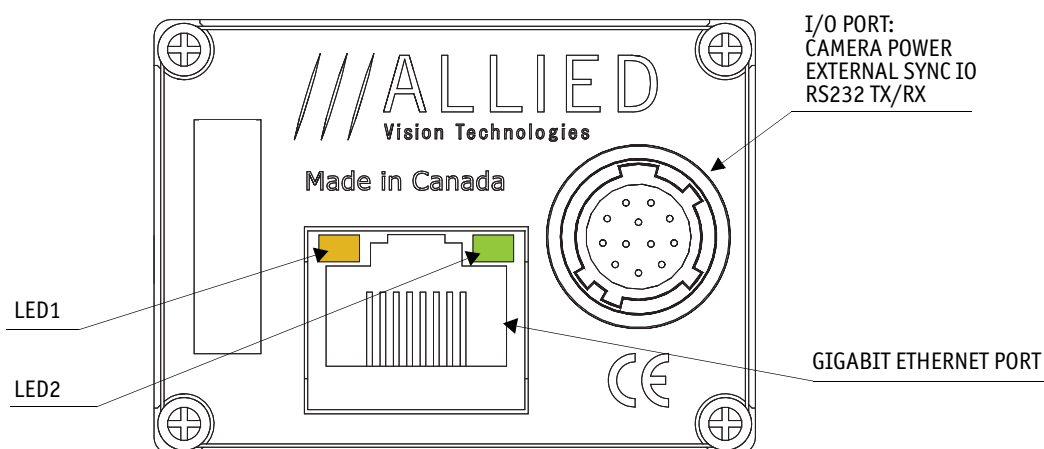


Figure 34: Prosilica GC connection ports

## Status LEDs

The color of the LEDs have the following meaning:

| LED Color |                         | Status                                                  |
|-----------|-------------------------|---------------------------------------------------------|
| LED1      | Flashing / solid orange | Ethernet activity                                       |
| LED2      | Flashing green          | Camera is powered                                       |
|           | Solid green             | Camera is booted, and link with the host is established |

Table 19: Status of LEDs in Prosilica GC

### Note



Once the camera is booted, LED2 will remain solid green as long as the camera is powered, even if connection with the host is lost.

## Gigabit Ethernet port

The Gigabit Ethernet port conforms to the IEEE 802.3 1000BASE-T standard for Gigabit Ethernet over copper. We recommend using Category 6 or higher compatible cabling and connectors for best performance.

### www



The **AVT GigE Installation Manual** offers detailed instructions for using Prosilica GC cameras.

[http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical\\_Manual/GigE\\_Install\\_Manual/AVT\\_GigE\\_Installation\\_Manual.pdf](http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical_Manual/GigE_Install_Manual/AVT_GigE_Installation_Manual.pdf)

### Note



See **Hardware Selection for AVT GigE Cameras** application note for a list of recommended Ethernet adapters:

[http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application\\_Notes/Hardware\\_Selection\\_for\\_AVT\\_GigE\\_Cameras.pdf](http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/Hardware_Selection_for_AVT_GigE_Cameras.pdf)

A standard Ethernet adapter is available for purchase from AVT:  
AVT P/N: 02-3002A  
Model: Intel Pro 1000/PT

### Note



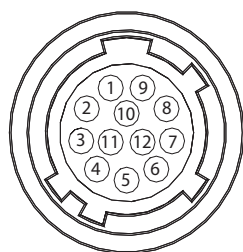
Cable lengths up to 100 m are supported.

The 8-pin RJ-45 jack has the pin assignment according to the Ethernet standard (IEEE 802.3 1000BASE-T).

Cables with screw-lock connectors are available for purchase from AVT:

<http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html>

## Camera I/O connector pin assignment



| Pin                                                                                | Signal          | Direction | Level                                                                                          | Description                             |
|------------------------------------------------------------------------------------|-----------------|-----------|------------------------------------------------------------------------------------------------|-----------------------------------------|
| 1                                                                                  | Camera GND      | In        | GND for ext. power                                                                             | Ground for camera power supply          |
| 2                                                                                  | Camera Power    | In        | 5–16* VDC                                                                                      | Camera power supply                     |
| 3                                                                                  | In 1            | In        | $U_{in}(\text{high}) = 5\text{--}24\text{ V}$<br>$U_{in}(\text{low}) = 0\text{--}0.8\text{ V}$ | Input 1 opto-isolated (SyncIn1)         |
| 4                                                                                  | Out 1           | Out       | Open emitter max. 20 mA                                                                        | Output 1 opto-isolated (SyncOut1)       |
| 5                                                                                  | Isolated IO GND | In/Out    | Common GND for In/Out                                                                          | Isolated input and output signal ground |
| 6                                                                                  | Video iris      | Out       | ---                                                                                            | PWM signal for iris control             |
| 7                                                                                  | Reserved        | ---       | ---                                                                                            | ---                                     |
| 8                                                                                  | TxD RS-232      | Out       | RS-232                                                                                         | Terminal transmit data                  |
| 9                                                                                  | RxD RS-232      | In        | RS-232                                                                                         | Terminal receive data                   |
| 10                                                                                 | Signal GND      | ---       | ---                                                                                            | Ground for RS232 and non-isolated IO    |
| 11                                                                                 | In 2            | In        | LVTTTL max. 3.3 V                                                                              | Input 2 non-isolated (SyncIn2)          |
| 12                                                                                 | Out 2           | Out       | LVTTTL max. 3.3 V                                                                              | Output 2 non-isolated (SyncOut2)        |
| *Some models offer 5-25 VDC. See <a href="#">Camera power</a> section for details. |                 |           |                                                                                                |                                         |

Figure 35: Camera I/O connector pin assignment

The general purpose I/O port uses a Hirose HR10A-10R-12PB connector on the camera side. The mating cable connector is Hirose HR10A-10P-12S.

### Note



The cable side Hirose connector is available for purchase from AVT.  
AVT P/N: K7600040 or 02-7002A

## I/O definition

### Camera power

The Prosilica GC camera family has recently been updated to offer an expanded input power voltage range. The camera serial number is used to differentiate between cameras that offer 5–16 VDC and those that offer 5–25 VDC.

#### Caution



SN: 02-XXXXX-0XXXX, 5–16 V. 12 V nominal.

SN: 02-XXXXX-1XXXX, 5–25 V. 12 V nominal.

#### www



For more information on the power voltage range update for the Prosilica GC family:

[http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application\\_Notes/Technical\\_Note\\_-\\_Prosilica\\_GC\\_power\\_voltage\\_specification\\_update.pdf](http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/Technical_Note_-_Prosilica_GC_power_voltage_specification_update.pdf)

#### Note



A 12 V power adapter with Hirose connector is available for purchase from AVT:

- AVT P/N 02-8003A North America Supply.
- AVT P/N 02-8004A Universal Supply.

### Isolated IO ground

The **Isolated IO GND** connection provides the user ground reference and return path for **In 1**, and **Out 1**. It is recommended that the ground wiring be physically close to the **In/Out** wiring to prevent parasitic coupling. For example, a good cable design connects **In 1** to one conductor of a twisted pair, **Isolated IO GND** to the second conductor of the same twisted pair.

### RxD RS-232 and TxD RS-232

These signals are RS-232 compatible. These signals are not optically isolated. Tie RS-232 ground to **Signal GND** to complete the RS-232 circuit.

#### www



For complete RS-232 description and usage, see:

[http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application\\_Notes/AppNote\\_-\\_RS-232\\_AVT\\_GigE.pdf](http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/AppNote_-_RS-232_AVT_GigE.pdf)

## Input triggers

Input triggers allow the camera to be synchronized to an external event. The camera can be programmed to trigger on the rising edge, falling edge, both edges, or level of the signal. The camera can also be programmed to capture an image at some programmable delay time after the trigger event.

### In 1 – opto-isolated

**In 1** is optically isolated and can be used in electrically noisy environments to prevent false trigger events. Tie trigger ground to **Isolated IO GND** to complete the trigger circuit. Compared to the non-isolated trigger, **In 1** has a longer propagation time. It can be driven from **5 to 24 V** with a **minimum current source of 10 mA**. See [Camera I/O opto-isolated user circuit example](#) for wiring information.

### In 2 – non-isolated

**In 2** is not electrically isolated and can be used when environmental noise is inconsequential and faster trigger response is required. The required trigger signal is **low voltage TTL 3.3 V**. Tie trigger ground to **Signal GND** to complete the trigger circuit. See [Camera I/O non-isolated user circuit example](#) for wiring information.

#### Caution

Exceeding 5.1 V on **In 2** can permanently damage the camera.



## Output signals

Output signals can be assigned to a variety of internal camera signals via software. They can be configured to active high or active low. The internal camera signals are listed as follows:

|                      |                                                                                                    |
|----------------------|----------------------------------------------------------------------------------------------------|
| <i>Exposing</i>      | Corresponds to when camera is integrating light.                                                   |
| <i>Trigger Ready</i> | Indicates when the camera is ready to accept a trigger signal.                                     |
| <i>Trigger Input</i> | A relay of the trigger input signal used to “daisy chain” the trigger signal for multiple cameras. |
| <i>Readout</i>       | Valid when camera is reading out data.                                                             |
| <i>Imaging</i>       | Valid when camera is exposing or reading out.                                                      |
| <i>Strobe</i>        | Programmable pulse based on one of the above events.                                               |
| <i>GPO</i>           | User programmable binary output.                                                                   |

### **Out 1 – opto-isolated**

**Out 1** signal is optically isolated and requires a user voltage with a suitable pull up resistor. Tie signal ground to **Isolated IO GND** to complete the external circuit. See [Camera I/O opto-isolated user circuit example](#) for wiring information.

### **Out 2– non-isolated**

**Out 2** signal is not electrically isolated and can be used when environmental electrical noise is inconsequential and faster trigger response is required. Use **Signal GND** to complete the external circuit. The output signal is a **low voltage TTL, maximum 3.3 V. Not suitable for driving loads in excess of 24 mA**. See [Camera I/O non-isolated user circuit example](#) for wiring information.

### **Signal ground**

**Signal Ground** must be connected to the user's external circuit ground if **In 2** or **Out 2** is to be used, or if the RS-232 port is to be used. Note that **Signal Ground** is common with **Camera GND**; however, it is good practice to provide a separate ground connection for power and signal.

### **Video iris**

This signal can be used to drive the video input of a video iris lens. See [Video iris output description](#) section for wiring information.

### **Reserved**

These signals are reserved for future use and should be left disconnected.

## Video iris output description

Prosilica GC cameras provide built-in auto iris controls for controlling video-type auto-iris lenses. These lenses are available from many popular security lens companies including Pentax, Fujinon, Tamron, Schneider, etc.

Remote iris lens control allows the camera to be more adaptable to changing light conditions. It allows the user to manually control the exposure and gain values and rely solely on the auto iris for adjustment to ambient lighting.

### Caution



The following schematic uses CAMERA POWER to power the video iris lens, and assumes CAMERA POWER = 12 V. Most video iris lenses operate at a 8–16 V input voltage. **Therefore, this circuit is not appropriate if using a 24 V camera power supply. Doing so may irreparably damage your lens.** Please consult your video iris lens specifications for the appropriate drive voltage.

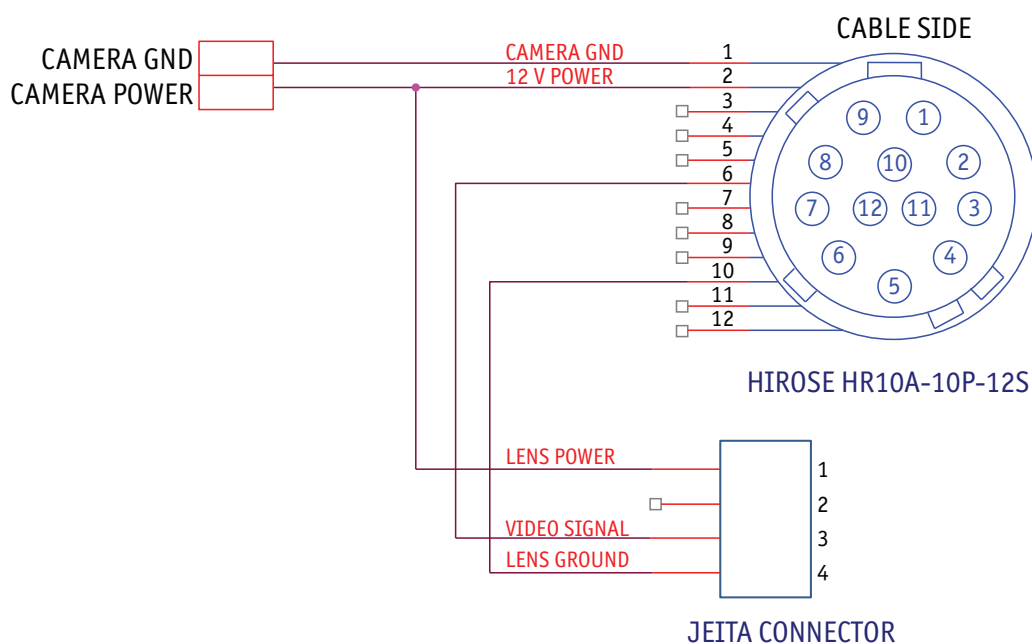


Figure 36: Prosilica GC video iris schematic

# Camera trigger

## Camera I/O opto-isolated user circuit example

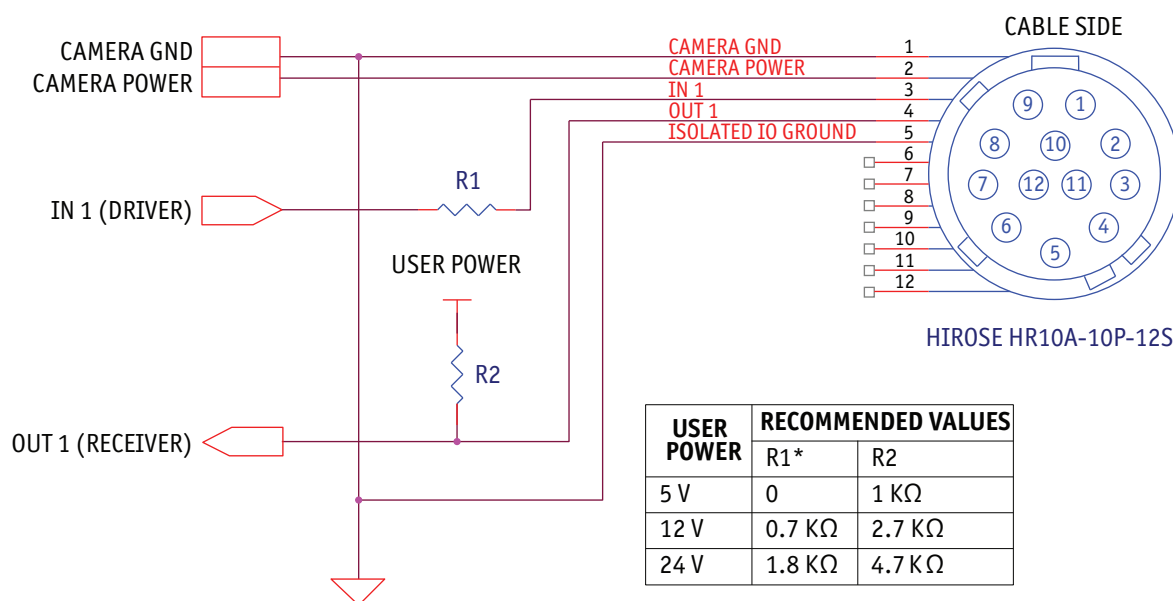


Figure 37: Prosilica GC opto-isolated user circuit

\*Cameras with SN: 02-XXXXX-0XXXX, R1 necessary for input greater than 5 V.  
Cameras with SN: 02-XXXXX-1XXXX, no R1 necessary, 5–24 V.

### Caution



**Input:** Incoming trigger must be able to source 10 mA.

**Output:** User power, with pull-up resistor R2 is required.

Isolated output is connected to the open collector of Fairchild MOCD207. The corresponding transistor emitter is connected to isolated ground. See the Fairchild MOCD207 datasheet for more detailed information.

## Camera I/O non-isolated user circuit example

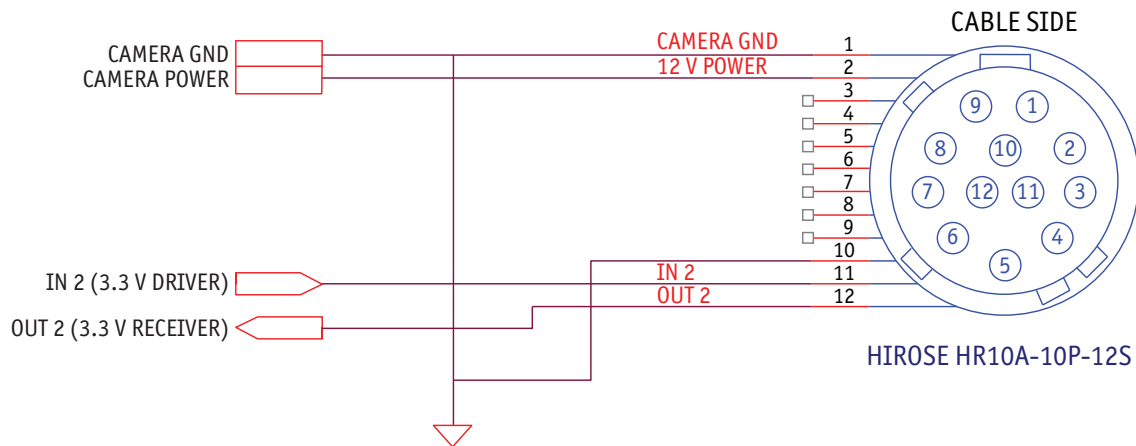


Figure 38: Prosilica GC non-isolated user circuit

### Caution



**Input:** Incoming trigger must be able to source 10  $\mu$ A, at 3.3 V. Input trigger voltage greater than 5.5 V will damage the camera.

**Output:** The maximum sync output current is 24 mA, at 3.3 V.

The non-isolated trigger circuit is connected to a Texas Instruments SN74LVC2G241 buffer/driver inside the camera. See the Texas Instruments SN74LVC2G241 for more detailed information.

## Trigger timing diagram

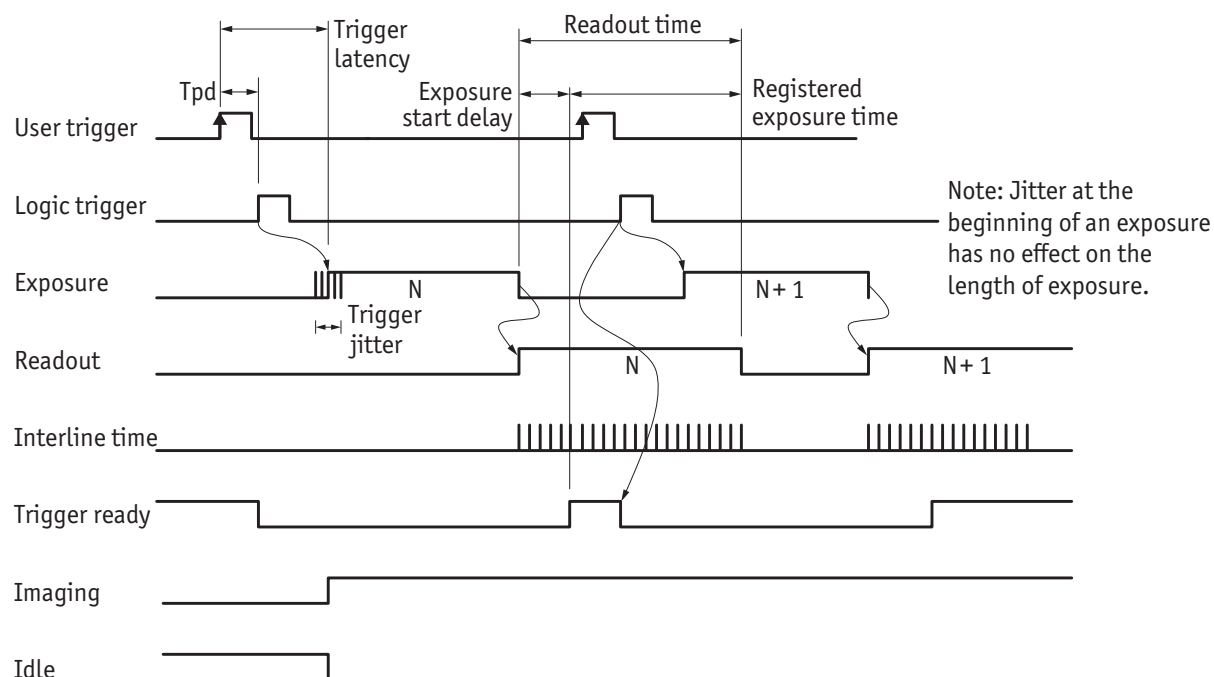


Figure 39: Prosilica GC internal signal timing waveforms

### Notes on triggering

| Term            | Definition                                                                 |
|-----------------|----------------------------------------------------------------------------|
| User trigger    | Trigger signal applied by the user (hardware trigger, software trigger)    |
| Logic trigger   | Trigger signal seen by the camera internal logic (not visible to the user) |
| Tpd             | Propagation delay between the user trigger and the logic trigger           |
| Exposure        | High when the camera image sensor is integrating light                     |
| Readout         | High when the camera image sensor is reading out data                      |
| Trigger latency | Time delay between the user trigger and the start of exposure              |
| Trigger jitter  | Error in the trigger latency time                                          |

Table 20: Explanation of signals in timing diagram

| Term                     | Definition                                                                                                                                                                |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trigger ready            | Indicates to the user that the camera will accept the next trigger                                                                                                        |
| Registered exposure time | Exposure time value currently stored in the camera memory                                                                                                                 |
| Exposure start delay     | Registered exposure time subtracted from the read-out time and indicates when the next exposure cycle can begin such that the exposure will end after the current readout |
| Interline time           | Time between sensor row readout cycles                                                                                                                                    |
| Imaging                  | High when the camera image sensor is either exposing and/or reading out data                                                                                              |
| Idle                     | High if the camera image sensor is not exposing and/or reading out data                                                                                                   |

Table 20: Explanation of signals in timing diagram

## Trigger rules

### Note



The **user trigger pulse width** should be at least three times the width of the trigger latency as indicated in Chapter [Specifications](#) on page 12.

- The **end of exposure** will always trigger the next readout.
- The **end of exposure** must always end after the current readout.
- The **start of exposure** must always correspond with the interline time if readout is true.
- **Exposure start delay** equals the readout time minus the registered exposure time.

## Triggering during the idle state

For applications requiring the shortest possible *Trigger Latency* and the smallest possible *Trigger Jitter* the *User Trigger* signal should be applied when *Imaging* is false and *Idle* is true. In this case, *Trigger Latency* and *Trigger Jitter* are as indicated in the camera [specifications](#) section.

## Triggering during the readout state

For applications requiring the fastest triggering cycle time whereby the camera image sensor is exposing and reading out simultaneously, apply the *User Trigger* signal as soon as a valid *Trigger Ready* is detected. In this case, *Trigger Latency* and *Trigger Jitter* can be up to 1 row time since *Exposure* must always begin on an *Interline* boundary.

## Firmware update

Firmware updates are carried out via the GigE connection. AVT provides an application for all Prosilica GC cameras that loads firmware to the camera using a simple interface. New feature introductions and product improvements motivate new firmware releases. All users are encouraged to use the newest firmware available and complete the firmware update if necessary.

**www**



Download the latest GigE firmware loader from the AVT website:

<http://www.alliedvisiontec.com/us/support/downloads/firmware.html>

**www**



For more information on GigE firmware update:

[http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application\\_Notes/AppNote\\_-\\_GigE\\_Firmware\\_Update.pdf](http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/AppNote_-_GigE_Firmware_Update.pdf)

## Resolution and ROI frame rates

This section charts the resulting frame rate from changing sensor region of interest (ROI), from full image to a single line.

### Note



- Frame rate data was generated using **StreamBytesPerSecond = 124 MB/s** and an 8-bit pixel format such as Mono8, BayerBG8, or BayerRG8. Frame rates may be lower if using network hardware incapable of 124 MB/s.
- The camera frame rate can be increased by reducing the camera's Height attribute, resulting in a decreased region of interest (ROI) or "window".
- The camera frame rate can also be increased by increasing the camera's BinningY attribute, resulting in a vertically scaled image (less overall height with same field of view).
- There is no frame rate increase with reduced width.

## Prosilica GC650

$$\text{Frame rate} = \frac{1}{19.94 \mu\text{s} \times \text{Height} + 1224.13 \mu\text{s}}$$

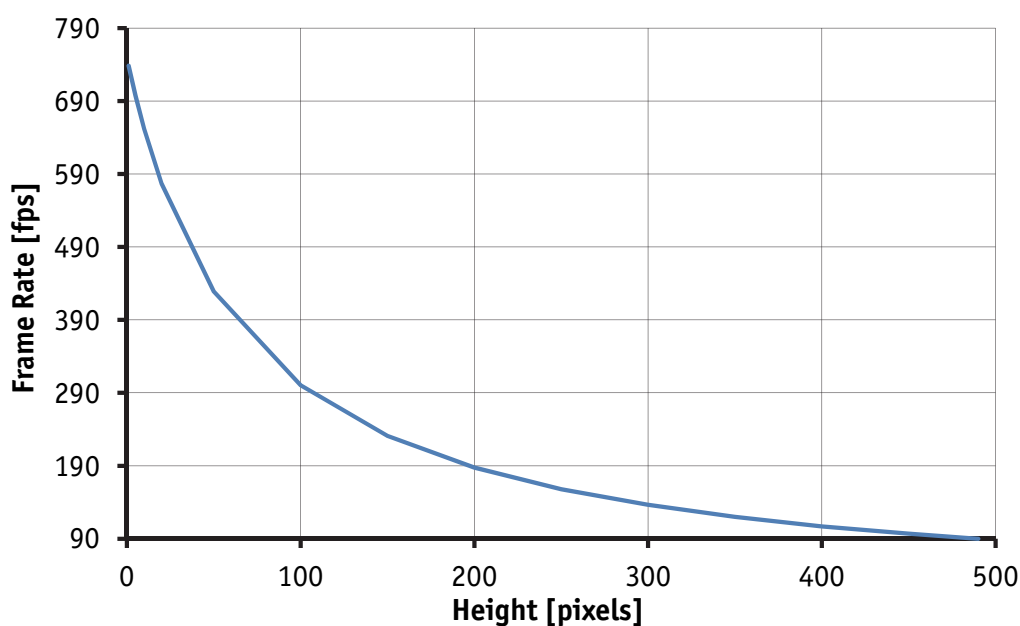


Figure 40: Frame rate vs. height for Prosilica GC650

## Prosilica GC655

$$\text{Frame rate} = \frac{1}{19.94 \mu\text{s} \times \text{Height} + 1224.14 \mu\text{s}}$$

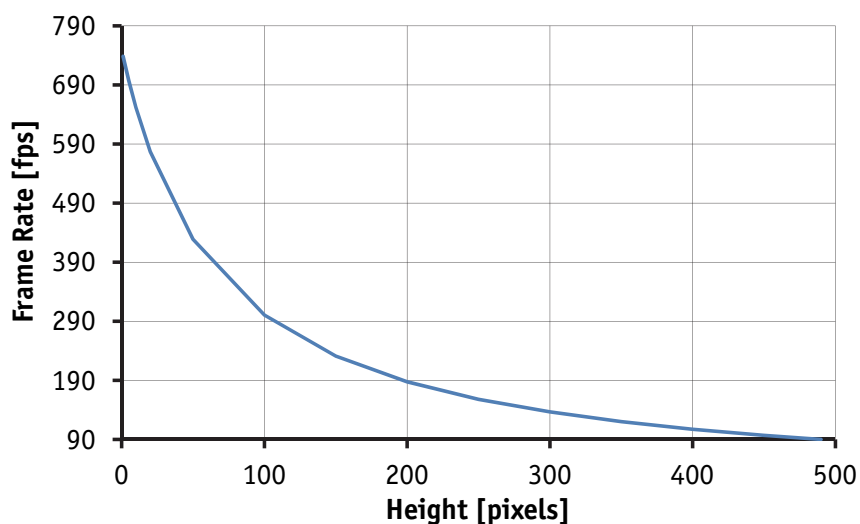


Figure 41: Frame rate vs. height for Prosilica GC655 (empirical)

## Prosilica GC660

$$\text{Frame rate} = \frac{1}{13.28 \mu\text{s} \times \text{Height} + 1844.77 \mu\text{s}}$$

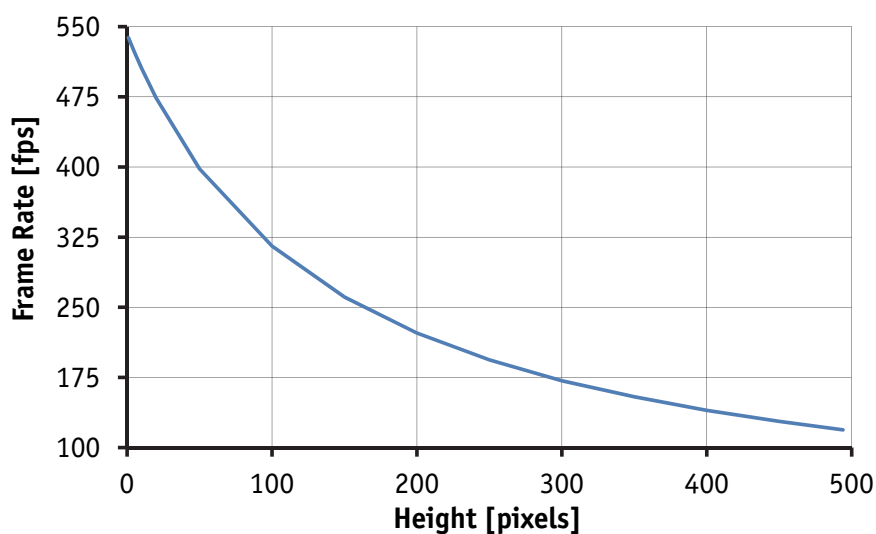


Figure 42: Frame rate vs. height for Prosilica GC660

## Prosilica GC750

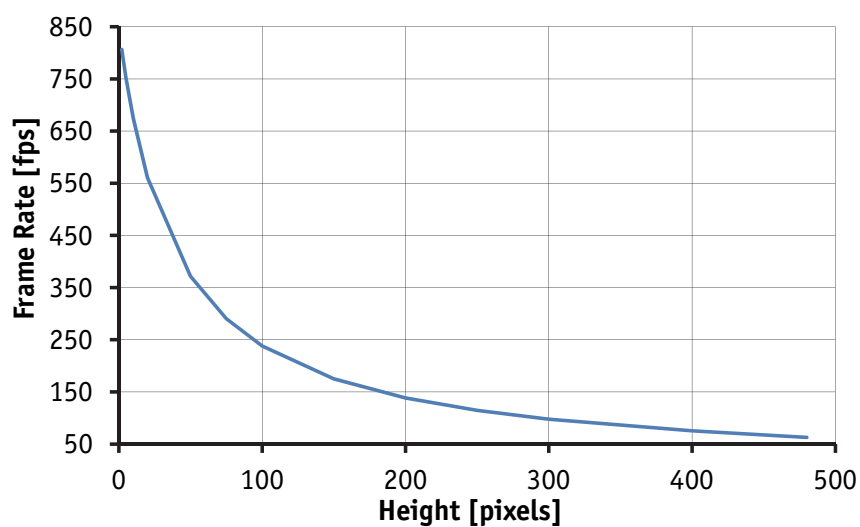


Figure 43: Frame rate vs. height for Prosilica GC750

## Prosilica GC780

$$\text{Frame rate} = \frac{1}{24.70 \mu\text{s} \times \text{Height} + 1139.14 \mu\text{s}}$$

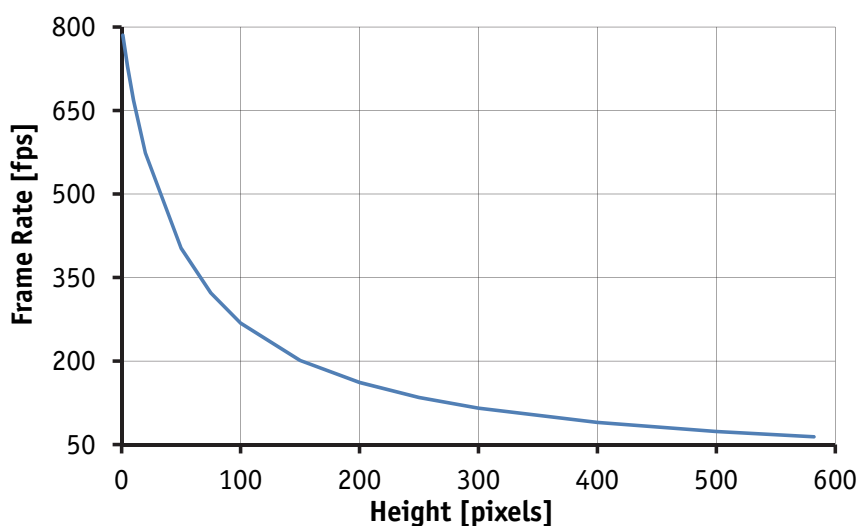


Figure 44: Frame rate vs. height for Prosilica GC780

## Prosilica GC1020

$$\text{Frame rate} = \frac{1}{33.56 \mu\text{s} \times \text{Height} + 3971.23 \mu\text{s}}$$

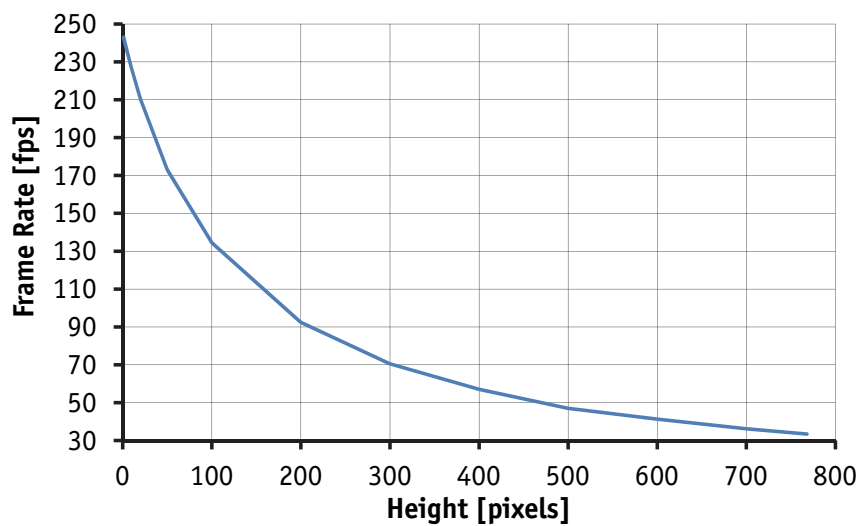


Figure 45: Frame rate vs. height for Prosilica GC1020

## Prosilica GC1280

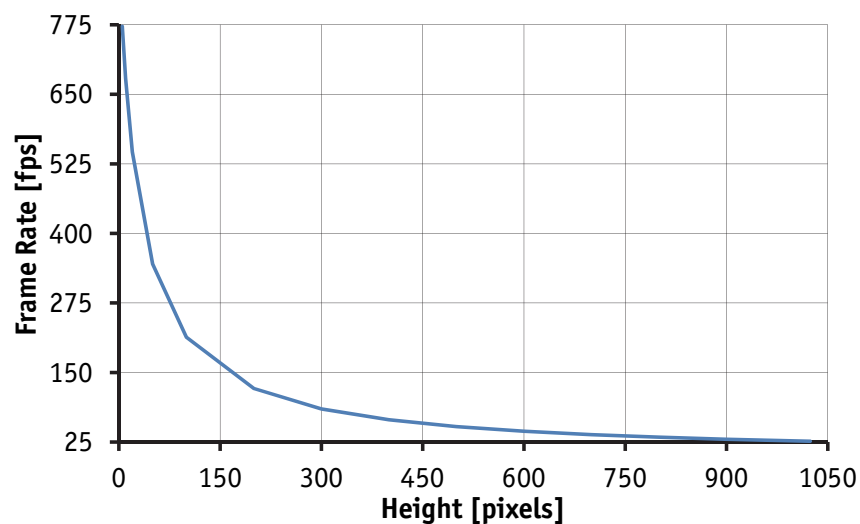


Figure 46: Frame rate vs. height for Prosilica GC1280

## Prosilica GC1290

$$\text{Frame rate} = \frac{1}{28.79 \mu\text{s} \times \text{Height} + 2937.68 \mu\text{s}}$$

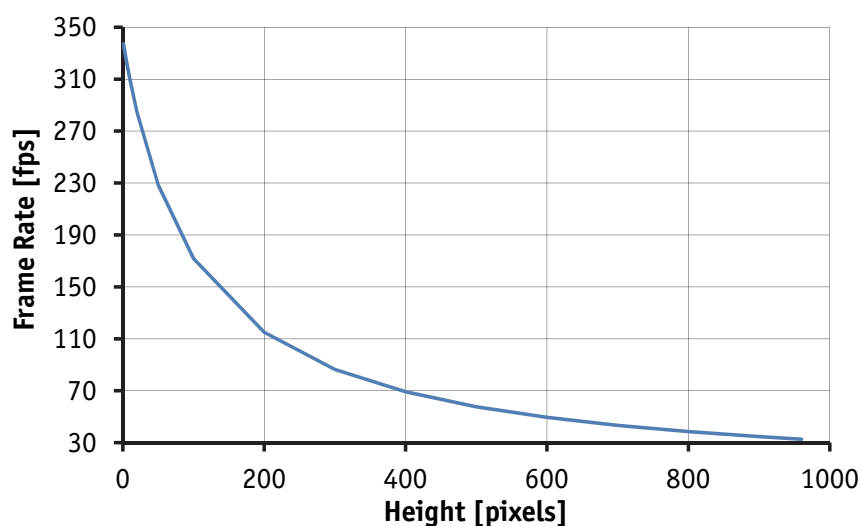


Figure 47: Frame rate vs. height for Prosilica GC1290

## Prosilica GC1350

$$\text{Frame rate} = \frac{1}{38.35 \mu\text{s} \times \text{Height} + 10457.12 \mu\text{s}}$$

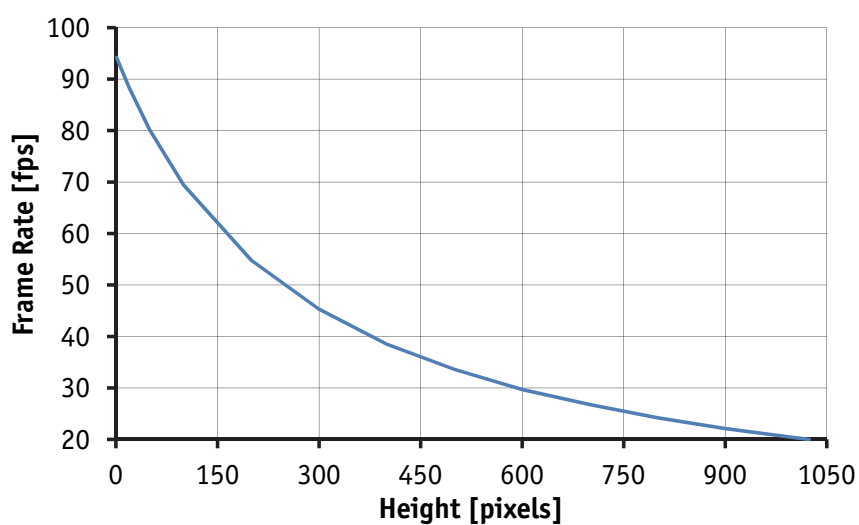


Figure 48: Frame rate vs. height for Prosilica GC1350

## Prosilica GC1380

$$\text{Frame rate} = \frac{1}{41.45 \mu\text{s} \times \text{Height} + 7148.57 \mu\text{s}}$$

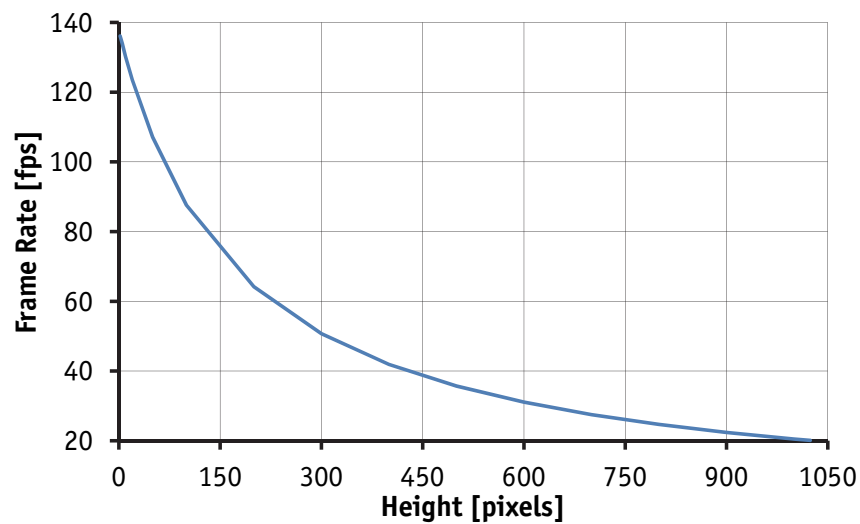


Figure 49: Frame rate vs. height for Prosilica GC1380

## Prosilica GC1380H

$$\text{Frame rate} = \frac{1}{27.78 \mu\text{s} \times \text{Height} + 4883.81 \mu\text{s}}$$

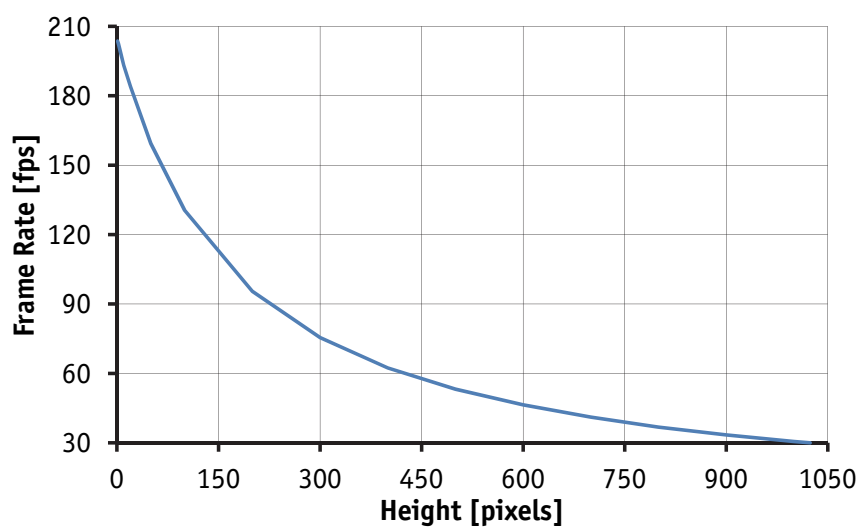


Figure 50: Frame rate vs. height for Prosilica GC1380H

## Prosilica GC1600

$$\text{Frame rate} = \frac{1}{48.80 \mu\text{s} \times \text{Height} + 6431.90 \mu\text{s}}$$

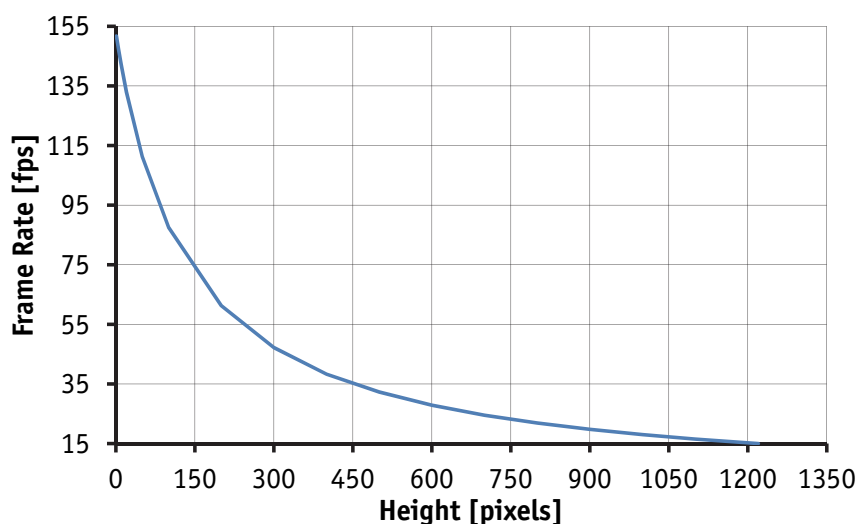


Figure 51: Frame rate vs. height for Prosilica GC1600

## Prosilica GC1600H

$$\text{Frame rate} = \frac{1}{29.24 \mu\text{s} \times \text{Height} + 3082.14 \mu\text{s}}$$

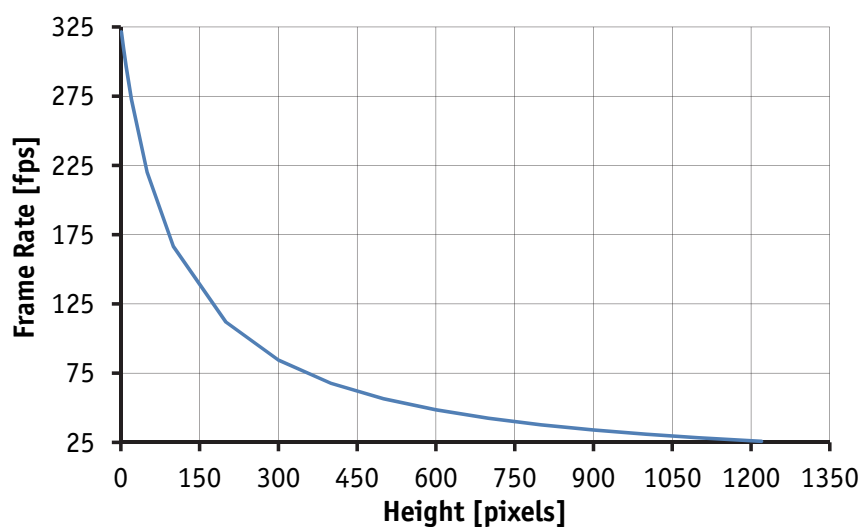


Figure 52: Frame rate vs. height for Prosilica GC1600H

## Prosilica GC2450

$$\text{Frame rate} = \frac{1}{26.63 \mu\text{s} \times \text{Height} + 12079.91 \mu\text{s}}$$

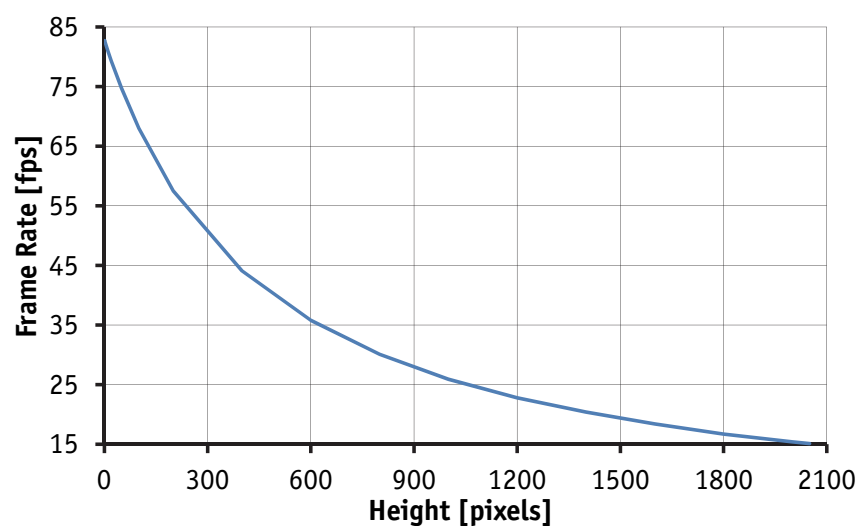


Figure 53: Frame rate vs. height for Prosilica GC2450

## Prosilica GC model comparison

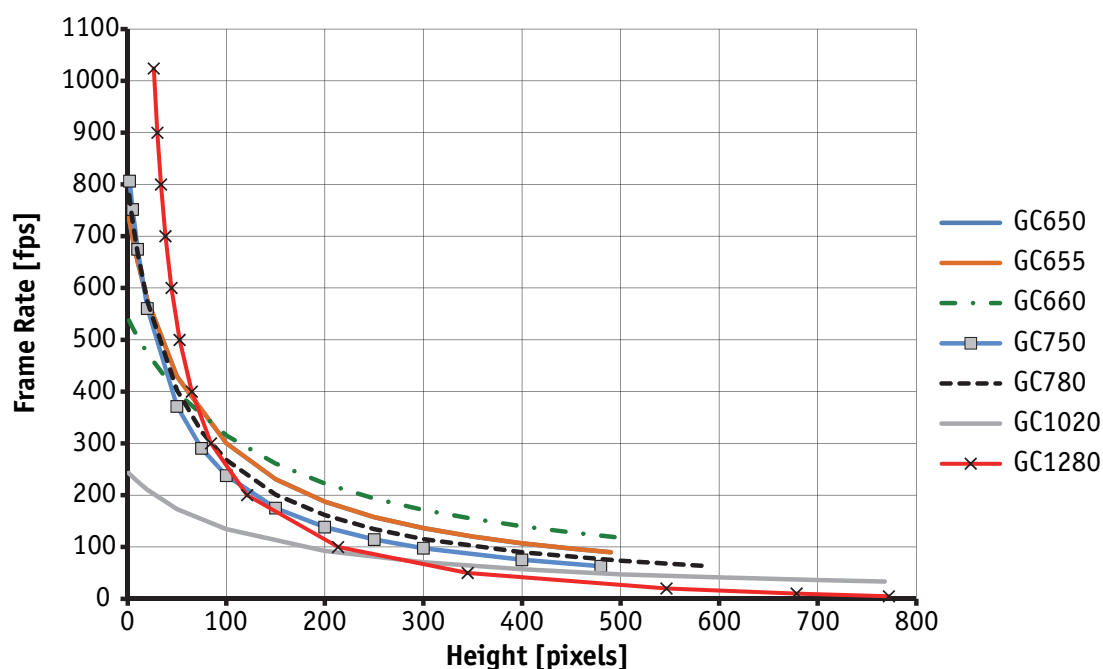


Figure 54: Maximum frame rate comparison for select models

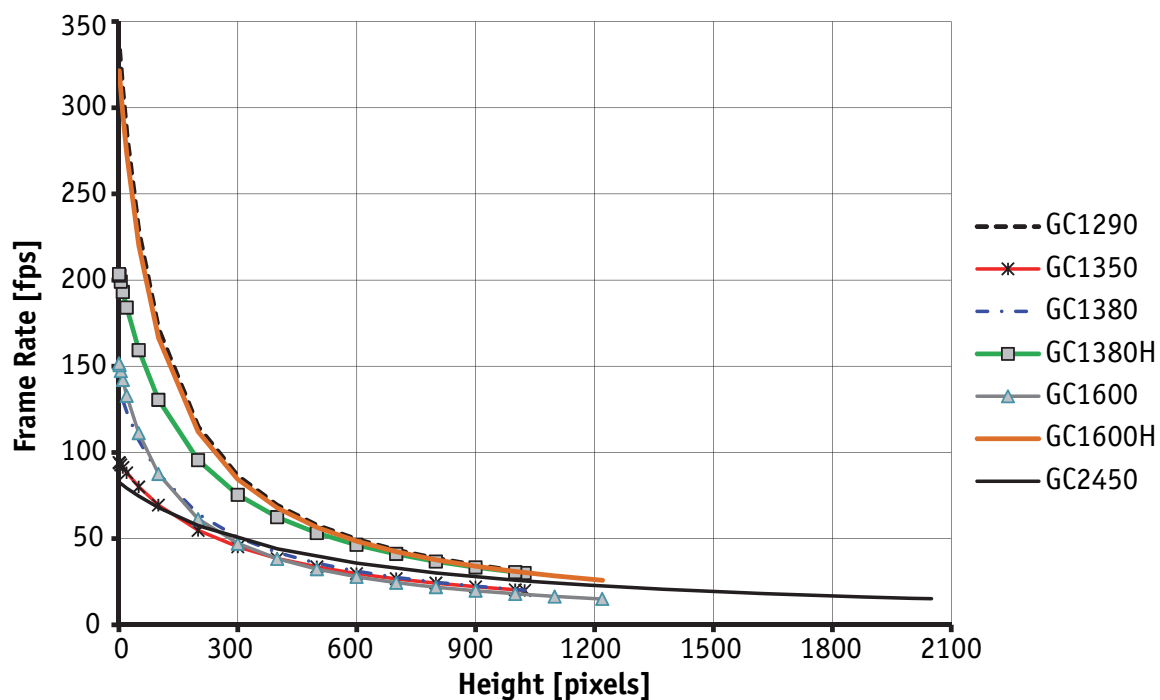


Figure 55: Maximum frame rate comparison for select models

## Description of the data path

The following diagrams illustrate the data flow and the bit resolution of image data. The individual blocks are described in more detail in the **AVT GigE Camera and Driver Features** document.

### Prosilica GC: monochrome cameras

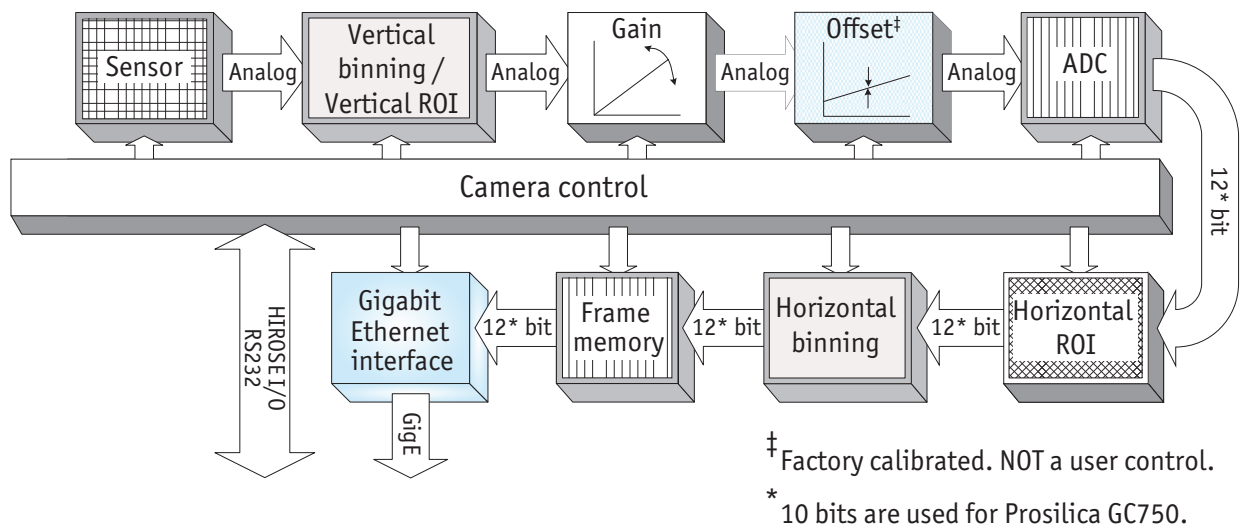


Figure 56: Block diagram of monochrome Prosilica GC cameras

### Prosilica GC: color cameras

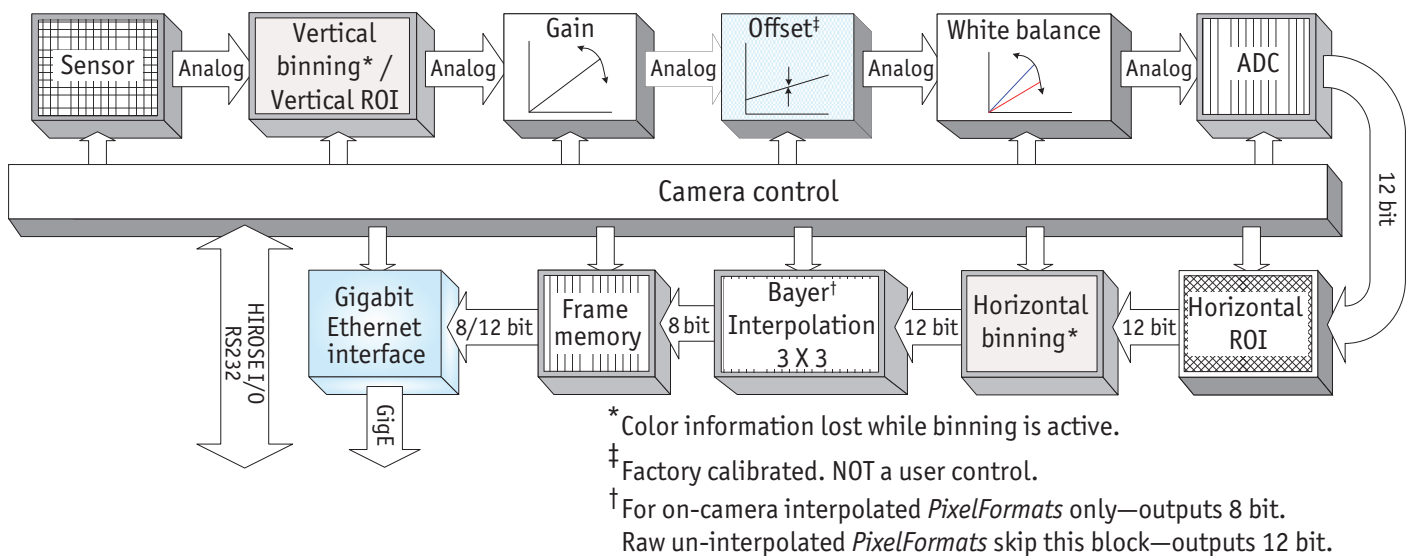
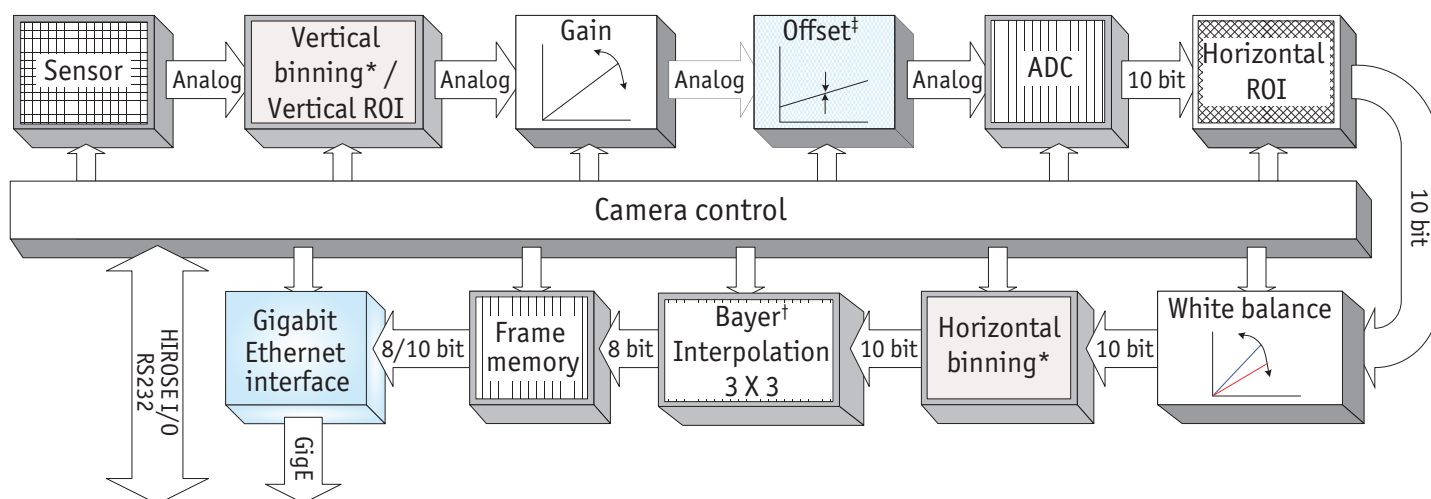


Figure 57: Block diagram of color Prosilica GC cameras (except GC750C)

## Prosilica GC750C



\*Color information lost while binning is active.

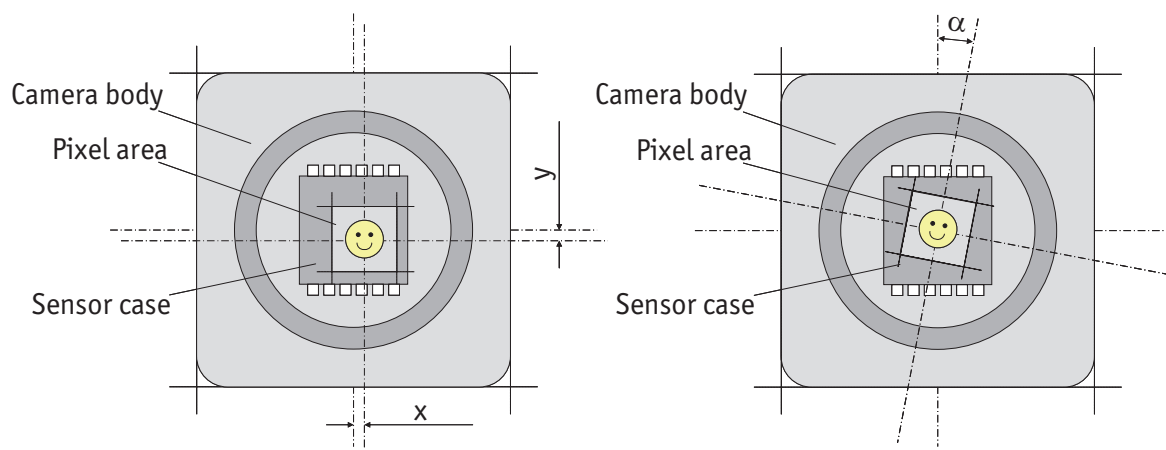
†Factory calibrated. NOT a user control.

‡For on-camera interpolated *PixelFormats* only—outputs 8 bit.  
Raw un-interpolated *PixelFormats* skip this block—outputs 10 bit.

Figure 58: Block diagram for Prosilica GC750C

## Appendix

### Sensor position of Prosilica GC cameras



**Method of Positioning:** Video alignment of photo sensitive sensor area into camera front module. (lens mount front flange)

**Reference points:** Sensor: Center of pixel area (photo sensitive cells)  
Camera: Center of camera front flange (outer case edges)

**Accuracy:**

|     |         |                   |
|-----|---------|-------------------|
| x/y | ±400 μm | (Sensor shift)    |
| α   | ± 1°    | (Sensor rotation) |

## Additional references

### **Prosilica GC webpage**

<http://www.alliedvisiontec.com/us/products/cameras/gigabit-ethernet/prosilica-gc.html>

### **Prosilica GC Documentation**

<http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-gc.html>

### **AVT VIMBA SDK**

<http://www.alliedvisiontec.com/us/products/software/vimba-sdk.html>

### **AVT GigE PvAPI SDK**

<http://www.alliedvisiontec.com/us/products/legacy.html>

### **AVT Knowledge Base**

<http://www.alliedvisiontec.com/us/support/knowledge-base.html>

### **AVT Case Studies**

<http://www.alliedvisiontec.com/us/products/application-markets/industrial-inspection.html>

### **Prosilica GC Firmware**

<http://www.alliedvisiontec.com/us/support/downloads/firmware.html>

# Index

## B

|                                       |    |
|---------------------------------------|----|
| Block diagram                         |    |
| Prosilica GC color cameras.....       | 69 |
| Prosilica GC monochrome cameras ..... | 69 |
| Prosilica GC750C .....                | 70 |

## C

|                         |        |
|-------------------------|--------|
| Camera dimensions ..... | 42     |
| Camera GND.....         | 50, 53 |
| Camera interfaces ..... | 48     |
| Camera Power .....      | 50     |
| CE.....                 | 11     |
| Cleaning optics .....   | 9      |
| Copyright.....          | 2      |

## D

|                                |    |
|--------------------------------|----|
| Data path.....                 | 69 |
| Declaration of conformity..... | 11 |
| Document history .....         | 6  |

## E

|                                     |    |
|-------------------------------------|----|
| Environmental specifications .....  | 9  |
| Exposing (trigger) .....            | 58 |
| Exposure (definition) .....         | 57 |
| Exposure cycle (trigger).....       | 58 |
| Exposure start delay (signal) ..... | 58 |

## F

|                   |    |
|-------------------|----|
| FCC Class A ..... | 11 |
|-------------------|----|

## G

|                          |    |
|--------------------------|----|
| GND for ext. power ..... | 50 |
|--------------------------|----|

## I

|                                   |            |
|-----------------------------------|------------|
| Idle (signal) .....               | 58         |
| Imaging (signal) .....            | 58         |
| Input triggers                    |            |
| In 1 .....                        | 50, 51, 52 |
| In 2 .....                        | 50, 52, 53 |
| Integrating light (trigger) ..... | 57         |
| Interline boundary.....           | 58         |

|                              |            |
|------------------------------|------------|
| Interline time (signal)..... | 58         |
| Isolated IO GND.....         | 50, 52, 53 |
| Isolated IO ground.....      | 51         |

## L

|                                  |    |
|----------------------------------|----|
| Legal notice .....               | 2  |
| Logic trigger (definition) ..... | 57 |

## M

|                                 |    |
|---------------------------------|----|
| Mechanical Drawing              |    |
| Prosilica GC CCD models.....    | 43 |
| Prosilica GC CMOS models .....  | 42 |
| Prosilica GC tripod mount ..... | 44 |
| Multicast .....                 | 40 |

## O

|                                    |            |
|------------------------------------|------------|
| Optical flange focal distance..... | 45         |
| Output signals                     |            |
| Out 1 .....                        | 50, 51, 53 |
| Out 2 .....                        | 50, 53     |

## P

|                                   |    |
|-----------------------------------|----|
| Precautions .....                 | 8  |
| Propagation delay (trigger) ..... | 57 |

## R

|                                         |        |
|-----------------------------------------|--------|
| Reading out data (trigger).....         | 58     |
| Readout (definition) .....              | 57     |
| Readout data (trigger).....             | 57     |
| Region of interest.....                 | 40, 60 |
| Registered exposure time (signal) ..... | 58     |
| RoHS (2011/65/EU).....                  | 11     |
| RS-232 .....                            | 50     |

## S

|                                       |                |
|---------------------------------------|----------------|
| Sensor position of Prosilica GC ..... | 71             |
| Sensor row readout cycles .....       | 58             |
| Signal GND.....                       | 50, 51, 52, 53 |
| Specifications .....                  | 12             |
| Spectral sensitivity                  |                |
| Prosilica GC1020 monochrome.....      | 23             |

|                                    |    |
|------------------------------------|----|
| Prosilica GC1020C color .....      | 23 |
| Prosilica GC1280 monochrome .....  | 25 |
| Prosilica GC1290 monochrome .....  | 27 |
| Prosilica GC1290C color .....      | 27 |
| Prosilica GC1350 monochrome .....  | 29 |
| Prosilica GC1350C color .....      | 29 |
| Prosilica GC1380 monochrome .....  | 31 |
| Prosilica GC1380C color .....      | 31 |
| Prosilica GC1380CH color .....     | 33 |
| Prosilica GC1380H monochrome ..... | 33 |
| Prosilica GC1600 monochrome .....  | 35 |
| Prosilica GC1600CH color .....     | 37 |
| Prosilica GC1600H monochrome ..... | 37 |
| Prosilica GC2450 color .....       | 39 |
| Prosilica GC2450C color .....      | 39 |
| Prosilica GC650 monochrome .....   | 13 |
| Prosilica GC650C color .....       | 13 |
| Prosilica GC655 monochrome .....   | 15 |
| Prosilica GC655C color .....       | 15 |
| Prosilica GC660 monochrome .....   | 17 |
| Prosilica GC660C color .....       | 17 |
| Prosilica GC750 monochrome .....   | 19 |
| Prosilica GC750C color .....       | 19 |
| Prosilica GC780 monochrome .....   | 21 |
| Prosilica GC780C color .....       | 21 |
| Spectral transmission              |    |
| IRC30 filter .....                 | 41 |
| Status LEDs .....                  | 48 |
| StreamBytesPerSecond .....         | 60 |
| Styles .....                       | 7  |
| Symbols .....                      | 8  |

## T

|                                    |    |
|------------------------------------|----|
| Time delay (trigger) .....         | 57 |
| Tpd (definition) .....             | 57 |
| Trademarks .....                   | 2  |
| Trigger jitter (definition) .....  | 57 |
| Trigger latency (definition) ..... | 57 |
| trigger latency time .....         | 57 |
| Trigger ready (signal) .....       | 58 |
| trigger rules .....                | 58 |
| Trigger timing diagram .....       | 57 |

## U

|                                 |    |
|---------------------------------|----|
| User trigger (definition) ..... | 57 |
|---------------------------------|----|

## V

|                  |        |
|------------------|--------|
| Video Iris ..... | 50, 53 |
|------------------|--------|

## W

|                |   |
|----------------|---|
| Warranty ..... | 2 |
|----------------|---|